ATT

ENVIRONMENTAL SAMPLING AND ANALYSIS PLAN FOR NAVAL STATION, TREASURE ISLAND, HUNTERS POINT ANNEX, SAN FRANCISCO, CALIFORNIA

March 14, 1991

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Table of Contents

Table of Contents
(continued)

Table of Contents
(continued)

Page No.

LIST OF TABLES

LIST OF PLATES

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of the Environmental Sampling and Analysis Plan (ESAP) is to provide data to address specific environmental concerns at the Naval Station, Treasure Island, Hunters Point Annex (HPA), San Francisco, California. Environmental concerns focus on the potential environmental effects associated with the release of contaminants from HPA. The environmental effects to be addressed include potential contaminants in sediments, toxicity to organisms in contact with sediments, toxicity of storm water runoff, and potential accumulation of contaminants into surface waters. Regulatory agency comments on the ESAP and the responses to the comments are included in Appendix A.

The ESAP addresses environmental concerns resulting from activities at HPA and supplements previous environmental sampling programs. Based on the results of this study, the need for additional investigations will be evaluated.

1.2 SCOPE OF PLAN

The U.S. Environmental Protection Agency (EPA) has provided a basic framework for preparing an environmental evaluation. To the extent applicable and feasible, the following principal guidance documents were considered in preparation of the ESAP.

- EPA, Risk Assessment Guidance for Superfund: Environmental Evaluation Manual, Interim Final, Office of Emergency and Remedial Response, Washington, D.C., EPA/540/1-89/001A, March, 1989a
- EPA, Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Reference Document, Washington, D.C., EPA/600/3-89/013, March, 1989b
- EPA/COE, Draft Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters, Washington, D.C., EPA/503/8-90/002, January, 1990.

The ESAP was prepared by Aqua Terra Technologies, Inc. (ATT) to supplement existing sampling plans which address potential contamination at HPA. The existing sampling plans have been prepared for the following groups of sites: Group I (HLA, 1988a), Group II (HLA, 1988b), Group III (HLA, 1988c), Group IV (HLA, 1988d) Group V (HLA, 1990). A description of the four groupings is presented in Section 1.4. The listed sites within each group are presented in Table 1. The location and contents of underground storage tanks (USTs) at HPA is summarized in Table 2.

Implementation of the ESAP will provide data to address the environmental effects of potential contamination at HPA by completion of the three specific task objectives: evaluation of the toxicity of sediments to appropriate test organisms; evaluation of whether persistent and bioaccumulative substances may be entering the San Francisco Bay using transplanted mussels as a biological indicator; and evaluation of the toxicity of storm water runoff to sensitive test organisms. Toxicity testing resulting in significant toxic effects will be confirmed with chemical analysis of the toxic matrix or matrices. The proposed sampling and analytical program is presented in Table 3.

The ESAP focuses on specific environmental effects involving potential toxicity and bioaccumulation resulting from activities at HPA. More comprehensive ecological effects, such as changes in species diversity or abundance, will not be addressed due to the lack of comparative background information and the numerous natural factors known to cause changes in the benthos that may mask changes associated with contaminants

(NOAA, 1988). The ESAP does not address the issue of remediation. However, if chemical analyses and toxicity testing results indicate that substances from HPA are affecting sediment and water column quality off HPA, further investigations may be necessary.

Following implementation of the ESAP, data generated from the evaluation of persistent and bioaccumulative substances using transplanted mussels may be used to assess potential risk to human health from ingestion of shellfish. The data used will be appropriate for specific sites within each grouping and presented in the Public Health and Environmental Evaluation (PHEE) report which will be prepared separately for each group of sites.

1.3 SITE BACKGROUND

Site background information is essentially taken from the Workplan Volume 2A, Sampling Plan for Group I Sites (HLA, 1988a), unless otherwise specified.

1.3.1 Site Description

HPA is located in southeastern San Francisco at the tip of a peninsula extending eastward into San Francisco Bay (Plate 1). The HPA property covers 965 acres and is bounded on the north, east, and south by the San Francisco Bay and the Hunters Point district of San Francisco on the west. The adjoining Hunters Point district is comprised of both public and private housing and commercial and industrial buildings.

The northern and eastern shores of HPA are used for ship repair with drydock and berthing facilities. The southern shore, comprised of emplaced fill, is not used for shipping activities.

Level lowland areas, which were constructed by placing fill along the margin of the San Francisco Bay, comprise 70 to 80 percent of HPA. The remaining area is a moderately to steeply sloping ridge in the northwest portion of the HPA site. Elevations across the site range from approximately six to 10 feet above Mean Sea Level (MSL) in the lowland areas to 176 feet above MSL in the ridge area.

Surface drainage is primarily made up of unconcentrated sheet-flow runoff collected by onsite storm sewer systems and discharged to San Francisco Bay. Extensive grading and construction at HPA has filled or modified pre-existing drainage channels and no naturally occurring channelized drainage crosses the facility. The encroachment of bay water to the storm sewer system has been reported at both low and high tides (WESTDIV, 1990).

1.3.2 Site History

HPA was operated as a commercial dry dock facility from 1869 to December 1939, when the property was purchased by the Navy. Following the acquisition, the facility was leased to Bethlehem Steel Company until December 1941 at which time the Navy occupied the facility and operated the shipyards until 1974.

The naval facilities included industrial, office, and residential buildings. Waterfront facilities included forty deep-water berths 500 feet in length and six dry docks of different sizes. The principal facility activities during the Navy's use of the site (1941 to 1974) were ship construction, maintenance, and repair; radiological experiments; and ordinance operations.

Most of the shipyard was leased to Triple A in May 1976 and used by Triple A as a commercial ship repair facility until June 1987. Triple A subleased portions of the facility to private warehousing, commercial, and industrial firms. Wastes generated were associated with ship repair and maintenance, facility maintenance, and building demolition. Waste disposal was largely undocumented by Triple A during this period of time (DA, 1987).

Activities performed by both the Navy and Triple A resulted in the use of hazardous materials including paints, solvents, fuels and oils, acids and bases, metals, polychlorinated biphenyls (PCBs), and asbestos. Information on waste generation and disposal by the Navy from 1941 through 1974, including the identification of approximately 35 USTs, is presented in the Initial Assessment Study (IAS) (WESTEC, 1984).

Information on the alleged waste generation and waste disposal activities of Triple A from 1976 to 1987 is limited to that developed by the Navy and the San Francisco District Attorney (DA) (DA, 1987). No data are available regarding activities prior to 1941 or activities by Triple A's sublease holders; however, the Navy has conducted a "fence to fence" survey that focused on documentation and subsequent removal of surface hazardous materials left by sublease holders, the Navy and Triple A (ERM West, 1988).

1.3.3 Site Geology

Subsurface investigations at HPA have identified four geologic units which underlie the site. The oldest identified unit is bedrock of the Franciscan Complex which is exposed in the central upland ridge area of HPA. The bedrock unit is overlain in some areas by undifferentiated sedimentary deposits which consist of consolidated sands and clays. These deposits are in turn overlain by estuarine deposits of clay, silt, sand, and peat, termed "bay mud deposits" (bay mud). Fill derived from bedrock or industrial and domestic wastes has been emplaced over the bedrock and/or the bay mud in many areas of HPA. These units are described in more detail below.

The Franciscan complex bedrock is a tectonic assemblage of variably sized blocks of sandstone, greenstone, shale, chert, and serpentinite, often bounded by ancient inactive faults or shear zones. Serpentinite is the dominant bedrock type at HPA. Stiff clays and dense sands overlie bedrock along the southwestern margin of HPA. These units are not exposed at groundsurface, but are tentatively correlated with the "undifferentiated sedimentary deposits" reported by Bonilla (1971) and may be equivalent to the Colma formation of Quaternary age (past two million years). Prior test borings indicate that this unit is present at depth in the central and northeastern portion of HPA. However, the overall distribution of this unit beneath HPA has not been fully characterized.

Bay mud is comprised of estuarine deposits accumulated during approximately the last 11,000 years, and reaches thicknesses of about 50 feet in some portions of HPA (Lowney/Kaldveer, 1972). The bay muds consist of soft, saturated plastic silts and clays interbedded with sand and peat. Within the San Francisco Bay, these soft "younger bay mud" deposits grade into underlying stiff silts and clays termed "older bay mud" which may be present in the offshore areas of HPA. Due to the lack of soil boring data, the older bay mud cannot be differentiated from the underlying undifferentiated sedimentary deposits. Consequently, all of the stiff soils logged beneath the younger bay mud at HPA are collectively grouped with the undifferentiated sedimentary deposits.

During development of HPA, fill was placed over both bedrock and bay mud. Fill is estimated to cover approximately 70 to 80 percent of the shipyard area. There are two general types of fill; the first type is derived predominantly from excavation of the bedrock ridge and used to create level areas for shipyard activities; the second type of fill is generated from industrial activities (primarily sandblast waste) and includes industrial and domestic wastes. The bedrock fill varies in composition from mostly serpentinite to associated ultramafic rocks to mixtures of serpentinite and Franciscan sandstone, chert, greenstone, and shale. The Navy placed these fills in the bay margin beginning in the early to mid-1940s as a means of disposal for these materials.

1.3.4 Site Hydrogeology

Information concerning the local hydrogeology at HPA is limited to data obtained from shallow borings and monitoring wells installed as part of previous investigations, and pilot boring completed as part of the reconnaissance activities conducted by Harding Lawson Associates (HLA) (HLA, 1990a). As a result, the shallow aquifer occurring in the fill materials at HPA is the best understood. Shallow ground water in the fill materials is unconfined and the depth to the water table ranges from 2 to 12 feet. The undifferentiated sedimentary deposits comprise the second major aquifer beneath the site; the bay mud may act as a 5 to 50 foot thick aquitard between the unconsolidated fill and undifferentiated sedimentary deposits beneath most of the site (HLA, 1990b). Ground water may also occur in isolated sand zones within the bay mud and in the fractured bedrock. Hydrogeologic conditions in the undifferentiated sedimentary deposits and the effectiveness of the bay mud as an aquitard have not been characterized at HPA (HLA, 1990b).

Ground water in the shallow aquifer probably flows radially outward from inland bedrock areas of higher elevation toward the bay, where discharge occurs (HLA, 1990b). However, local ground water flow directions may be quite complex because of variations in topography and the hydraulic properties of subsurface fill materials. In addition, tidal fluctuations and localized recharge from storms likely influence flow directions (HLA, 1990b). Additional hydrogeologic information is being obtained from the primary phase RI activities which are ongoing at HPA.

1.4 SUMMARY OF PREVIOUS INVESTIGATIONS

1.4.1 Site Characterization

There have been numerous studies performed to (1) identify sites where usage, storage, or disposal of hazardous materials may have impacted the environment; and (2) characterize existing conditions at the identified sites. These investigations have been performed under the Navy Installation Restoration (IR) program. Concurrent with the IR studies, the DA's office investigated 20 sites potentially contaminated by Triple A activities at HPA (DA, 1987); these site locations are referred to as Triple A sites.

Under the IR program, there were originally 11 IR sites (IR-1 through IR-11) planned for Remedial Investigations and Feasibility Studies (RI/FS). These are sites where there is known contamination. The sites were grouped by the Navy as indicated in Table 1 to facilitate reporting requirements. Work plan documents for the RI/FSs at these sites were prepared. The grouping is based on the following: preliminary evaluation of the potential threat to public health and/or the environment; similarities in investigation or remediation; location of sites with respect to each other; and/or similar chemical conditions (HLA, 1988a).

Ten of the Triple A sites are encompassed by five of the IR sites; the remaining Triple A sites are separate. The remaining 10 Triple A sites were originally grouped into sites PA-12 through PA-18 on the basis of a preliminary assessment conducted for the Triple A sites (HLA, 1989). Site locations are shown on Plate 2.

As a result of the preliminary assessment and recommendations from EPA (HLA, 1989), five of the PA sites are being incorporated into the IR program in a newly formulated Operable Unit V. The prefix for the site numbers has been changed from "PA" to "IR" to reflect this inclusion. Volume 2F to the RI/FS work plan for HPA has been prepared to address the RIs at these sites (HLA,1990c). Site inspections are planned at sites PA-16 and PA-18 (HLA, 1990b). Recommendations for inclusion of these sites in the IR program will be based on the results of the site inspections. Each of these sites is included on Table 1.

In addition to the RI/FS and site inspection activities being conducted at the IR and PA sites, the Navy has conducted a preliminary assessment of the remaining HPA facility to identify areas where contamination may exist (HLA, 1990d). The areas being investigated include the storm sewer system and other underground

utilities; railroad tracks; electrical transformer locations; and areas outside of existing IR and PA site boundaries.

USTs at HPA have been previously identified and investigated. Information regarding the location and status of the USTs is presented in the UST "Removal Action Plan/Closure Plan" (PRC, 1990). The number, contents, and status of each UST is summarized in Table 2. UST locations are shown on Plate 2.

1.4.2. Environmental Sampling

The above activities are being conducted to characterize sites where contamination may exist. The environmental sampling activities are planned to address the environmental impacts of contamination originating from sites throughout the HPA facility. Several previous investigations provide a preliminary evaluation of the environmental impacts.

An Environmental Impact Statement (EIS) was prepared by Environmental Science Associates (ESA, 1987) to assess the potential effects of homeporting two ships of a Battleship Battlegroup, the U.S.S. Missouri and an escort cruiser, and a nine-ship Cruiser Destroyer Group in San Francisco Bay. The EIS examined sites at Naval Air Station-Alameda, Naval Station-Treasure Island and HPA. The selection of HPA as the preferred alternative homeporting site resulted in extensive environmental analyses at North Pier, South Pier and Dry Dock #4 (ESA, 1987). The primary focus of this study addressed the potential environmental effects of dredge sediments from areas of proposed use. The environmental analyses included verification testing of dredge sediments to verify and expand upon existing chemical toxicity information from an Initial Assessment Study performed by Ecology and Environment, Inc. in 1983. The Homeporting EIS verification testing included a total of ten sampling sites, three of which were located at HPA. Each sampling station was subdivided into five replicate substations. A core sample was taken at each of the five substations within a given station and the samples composited. Each composite sample was subjected to chemical analysis for metals, cyanide, pesticides and PCBs, polynuclear aromatic hydrocarbons (PAHs), phenolic compounds, total phtalates and total volatile organic compounds (VOCs). Two station samples were subjected to suspended particulate and solid phase bioassays.

Study results indicated that the metal concentrations measured during verification testing were substantially below Total Threshold Limit Concentrations (TTLC). The organic compounds which were detected, primarily PAHs, were at low concentrations well below levels reported to have the potential for significant effects on marine organisms. Among the organic chemicals tested for, but not detected in any sediments were phenolic compounds, DDT, and phtalates. The only pesticides detected were 4,4-DDD and 4,4-DDE, however reported concentrations were low. Acetone was the only volatile organic chemical found and was present in only trace amounts.

The suspended particulate phase bioassays conducted during the verification testing indicated that the Limiting Permissible Concentration (LPC) would not be exceeded during disposal of sediments from HPA. With the exception of the amphipod bioassay test, none of the solid phase bioassays conducted on Homeporting alternative site (including HPA) sediments exhibited significant mortalities. The mean amphipod survival in bioassay tests performed on HPA sediments was 45 percent, significantly lower compared to survival in the offshore reference sediments.

EMCON (1987) performed chemical and bioassay studies on dredge sediments in support of a maintenance dredging permit application for Dry Dock #4 at HPA. Three replicate surficial sediment samples were collected from each of five sampling sites in the vicinity of Dry Dock #4. Replicate samples were composited and were analyzed for sulfides, cyanides, metals, VOCs, total petroleum hydrocarbons (TPHs), semi-volatile organic compounds (SOCs), pesticides and PCBs, and radioactivity. Suspended particulate and solid phase bioassays were also performed on sediment samples collected from the Dry Dock #4 area. All of the analytes tested for were below regulatory target levels. The fish and mysid elutriate and solid phase

bioassays performed did not indicate that the LPC of the suspended particulate phase and the solid phase would be exceeded during ocean disposal of dredge materials from Dry Dock #4, HPA.

Storm water sampling was conducted by HLA in December of 1990 to characterize selected storm water runoff sources at HPA (HLA, 1988e). This study provided chemical characterization of storm water runoff quality at four locations selected to be representative of storm water runoff from various potential sources of contaminants near IR sites. Storm water samples were collected from each of the four stations and the samples subsequently analyzed for VOCs, SOCs, pesticides and PCBs, metals, TPHs, oil and grease and pH. The results of this study are not yet available. Additional storm water sampling is planned to characterize the chemical constituents of the storm water within the storm sewer system.

1.5 SUMMARY OF CHEMICAL CONDITIONS

Information on chemical conditions at HPA is essentially taken from the Workplan Volumes 2A through 2F for Group I, II, III, IV, and V Sites (HLA, 1988 a-e) unless otherwise specified. The summary provided is based on information from previous investigations. Additional site specific chemical information will be obtained from the ongoing tank closures, RIs and SIs at HPA.

Results of previous investigations at HPA indicate that inorganic and organic chemicals are present in soils at each IR site. Alleged Triple A disposal areas also require investigation and may involve widespread near-surface contamination with petroleum hydrocarbons, PCBs, and solvents. Chemicals detected in soil and groundwater from IR sites include volatile organic compounds (VOCs), semi-volatile organic compounds (SOCs), PCBs, oil and grease (O&G), heavy metals, and asbestos. Groundwater contamination has not been documented at each site. Sources of low-level radioactive materials (radium-coated dials) may be present at the landfill; low levels of radioactivity have been reported (HLA, 1990a). These levels are above background but below reportable levels. The results were presented to the public in Information Release Number 11 dated April 14, 1989 and in a Public Meeting on May 5, 1989. A summary of chemical conditions for IR and PA sites by group at HPA is described below and summarized in Table 1.

The highest sample concentrations and chemical diversity were found in Group I sites at the Oil Reclamation Ponds (IR-3), Industrial Landfill (IR-1) and Bay Fill Area (IR-2). Contamination at these IR sites consists of VOCs, SOCs, PCBs, oil and grease, and heavy metals.

Group II sites include IR-6, IR-8, IR-9 and IR-10. At IR-6, the Tank Farm, contamination consists primarily of diesel fuel and oil. PCBs are the primary contaminants detected at IR-8, Building 503 PCB spill area. At IR-9, the Pickling and Plate Yard, zinc chromate and acids are the primary contaminants of concern. Contamination at IR-10, The Battery and Electroplating Shop, consists primarily of waste acids, solvents, caustic soda and chromates

Group III sites include IR-3, the Scrap Yard and Triple A site 3 and IR-5, the Transformer Storage Yard. Heavy metals and PCBs, as well as oil and grease have been detected in soil and ground water samples from IR-3. PCBs were found in soil samples from six soil borings at IR-5.

Group IV sites include the Sub-base Area, IR-7, which consists of the painting area, the sandblast fill area and the 'additional' area. In the painting area, diesel fuel and other petroleum hydrocarbons, heavy metals and minor concentrations of VOCs were detected in soil samples. Petroleum related PAHs, diesel fuel, metals and one VOC were found in soil samples from the sandblasting fill area. In the 'additional' area of IR-7, PAHs, diesel and oil, metals and Freon 113 were found in soil samples.

Group V sites consist of IR-12, IR-13, IR-14, IR-15 and IR-17. One VOC, SOCs, and metals were detected in samples from IR-12, the Disposal Trenches and Salvage Yard. Contaminants found in soil samples from IR-13, the old Commissary, consists of SOCs, metals, hydrocarbons and the PCB isomer, Arochlor 1260. At

IR-14, the Oily Liquid Waste Disposal Area, detected contaminants include VOCs, metals and carbon disulfide. Contaminants detected at the Oily Waste Pond and Incineration Tank, IR-15, include PCBs, VOCs, SOCs, oil and grease and metals. Arochlor 1254 was found in soil samples from IR-17, the Drum Storage and Disposal Area.

The location and status of the USTs identified at HPA has been presented by PRC (1990). The USTs are known to contain the following substances: gasoline, diesel, fuel and waste oils, solvents, and water. The number, contents, and status of each UST is summarized in Table 2. UST locations are shown on Plate 2.

2.0 TASK 1 - EVALUATION OF SEDIMENT TOXICITY

2.1 STATEMENT OF PURPOSE

The ESAP establishes the procedures to be used for the evaluation of the potential toxicity of chemicals in the surficial bay sediments surrounding HPA. Surficial bay sediments are usually fine-grained with a high surface-to-volume ratio, often resulting in high levels of chemical adsorption (NOAA, 1988). Sediment contamination originating from past activities at HPA is of concern to the Navy and regulatory agencies because of the environmental sensitivity of San Francisco Bay and the organisms which reside there, particularly deposit feeders which tend to accumulate sediment contaminants.

Contamination of surficial sediments in the vicinity of HPA is of primary concern because contaminants in surficial sediments have the greatest potential for toxicity to benthic species. Chemistry and toxicity of both surficial and deeper sediments have been investigated in previous dredge sediment investigations (EMCON, 1987; ESA, 1987) in areas of present or proposed use at HPA. Because the toxicity of sediment-associated contaminants varies widely and is often obscured by chemical extraction for analyses (NOAA, 1988), the use of toxicity testing instead of, or in addition to, chemical analyses has merit. Therefore, the method proposed for the evaluation of the surficial sediments at HPA includes toxicity testing on composited sediment samples collected at 17 stations. Chemical analyses will be conducted on composited surficial samples from each station. The proposed sampling and analytical program is presented in Table 3.

Also of concern is the potential contamination of deeper sediments in the vicinity of HPA because of the potential for exposure of these sediments through current scouring thus increasing the potential for bioavailability of contaminants in deeper sediments. However, because the bioavailability of contaminants associated with deeper sediments is considered to be limited in their current position, the evaluation of these sediments will be restricted to chemical analysis of a discrete sediment core sample taken from a depth of 3 feet below the sediment water interface at each sediment station.

Because low levels of radioactivity have been reported at HPA (HLA, 1990a), all sediment samples will be screened for total radioactivity upon collection (See Section 2.4). Radioactivity measurements will be compared to the background level measured for the reference sediment sample and to regulatory radiation exposure levels for personal protection. Should the results of this radioactivity screen show counts of alpha, beta or gamma particles greater than background, additional samples will be collected and submitted to a radiation-certified analytical laboratory for confirmation of radioactivity. Should the results of the radioactivity screen show radiation levels greater than regulatory exposure levels for personal protection, further implementation of the ESAP will be discontinued until appropriate modifications can be made which address the issue of radioactivity at these elevated levels. No further action will be taken to address radioactivity if sample levels are within background levels.

The ESAP provides a methodology for evaluation of the toxicity of surficial sediments in the vicinity of HPA using a modified solid-phase bioassay procedure on selected estuarine species that may reside in the sediments. The bioassay will determine if there is a statistically significant decrease in mean survival of selected species in the sediments surrounding HPA relative to reference and control bioassays. Liquid suspended particulate phase bioassays will be conducted on sediment from the control station, two reference stations and 17 test stations to assess the toxicity of potential contaminants in the dissolved and suspended components of the sediments from HPA.

Collection, preparation, and solid-phase and liquid suspended particulate-phase bioassay procedures are referenced in the Environmental Protection Agency/Corps of Engineers (EPA-COE) Manual "Draft Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters" January, 1990. Because the procedures presented in this manual are used to determine the acceptability of disposed solids (dredged materials) to surface waters and their sediments, certain procedures were modified to address the

toxicity of non-dredged materials; modifications to specific procedures are discussed in the appropriate sections.

2.2 SELECTION OF SEDIMENT SAMPLING STATION AREAS

2.2.1 Selection of Test Station Areas

The following criteria were considered in the selection of proposed test station areas for HPA:

- o Proximity to areas of known or potential contamination, specifically IR and PA sites and UST locations identified in previous investigations
- o Past historical shoreline and berth uses
- o Areas of little or no influence from potential sources of contamination other than HPA
- o Accessibility for sampling

The proposed test station areas were all considered to be accessible sediment sampling areas of little or no influence from potential sources of contamination other than HPA. The stations were placed along the coastal perimeter of HPA from north to south, and in proximity to the HPA areas of known and potential contamination described in Table 1 and the status of confirmed USTs is summarized in Table 2. The 17 proposed stations and associated areas of known or potential contamination are listed below and shown on Plate 3. These locations are approximate and may be changed as more information regarding the hydrogeology of HPA is obtained from the RIs or UST investigations.

Station Number	Associated Site(s)	Outfall(s)
S-1	IR-7, PA-18	B
S-2	IR-6, IR-10	C
S-3	IR-6, IR-10	D
S-4	IR-6	---
S-5	IR-9	G,H,I,J
S-6	IR-8, IR-9	---
S-7	PA-16, IR-17	---
S-8	IR-11, IR-15, PA-16, IR-17	A
S-9	IR-2, IR-11, IR-15	---
S-10	IR-2, IR-3, IR-8, IR-11, IR-14, IR-15	---
S-11	IR-2, IR-5, IR-12, IR-13	---
S-12	IR-2, IR-4, IR-5, IR-12	---
S-13	IR-1, IR-4	---
S-14	IR-1	---
S-15	Dry Docks #2 and #3	---
S-16	S-203, S-209, S-210,S-215	E,F
S-17	Dry Dock #4	---

The EPA/COE (1990) manual describes procedures used for the sampling of sediments from within known dredging sites for use in the solid-phase bioassay and the liquid suspended particulate-phase bioassay. There is no information provided in this manual regarding the placement of sediment sampling stations in areas of potential contamination for use in the bioassays.

2.2.2 Selection of Control Station Area

A control station area will be used, for the purposes of this study, to verify the health of organisms used in the toxicity tests and the acceptability of bioassay test conditions. The following criteria were considered in the selection of the proposed control station area:

- o Area of little or no known contamination based on historical information and knowledge of the area
- o Area beyond the tidal influence of HPA; to be determined from review of National Oceanic and Atmospheric Administration (NOAA) tidal maps, if necessary
- o Area containing sediments of similar physical characteristics as test (HPA) sediments (e.g. grain size)
- o Area containing sediments that are compatible with the needs of the test organisms.

San Pablo Bay is proposed as the control station area for collection of control sediments to be used in the solid-phase bioassay and the liquid suspended particulate-phase bioassay. Sediment bioassay data from several locations within the San Francisco Bay show San Pablo Bay to be not toxic relative to a Puget Sound reference site (NOAA, 1988).

Possible control station areas in San Pablo Bay are shown on Plate 6. The final choice of the control station will depend on sediment grain size analysis results for sediments collected from the several potential control station areas in San Pablo Bay. The station area with sediments of a grain size closest to the sediment grain size encountered at HPA, will be used as the control station.

2.2.3 Selection of Reference Station Area

For the purpose of this study, reference station areas will be used as a basis for comparison to evaluate the potential background toxicity of sediments of similar physical characteristics from an area considered to be uncontaminated. The use of a reference station area for comparative purposes is a modification of the EPA/COE (1990) protocol which considers a reference station area to be a potential disposal site for dredged sediment. The following criteria were considered in the selection of the proposed reference station area:

- o Area of little or no known influence from potential sources of contamination at HPA based on historical information and knowledge of the area
- o Area containing sediments of similar physical characteristics as test (HPA) sediments (e.g. grain size)

Several areas within San Francisco Bay are proposed as the reference station areas for collection of reference sediments to be used in the solid-phase bioassay and the liquid suspended particulate phase bioassay as indicated on Plate 6.

2.3 SELECTION, COLLECTION, AND MAINTENANCE OF TEST SPECIES

2.3.1 Selection of Test Species

The following criteria were considered in the selection of proposed test species for use in the modified solid-phase bioassay and the liquid suspended particulate phase bioassay:

- o Appropriately sensitive benthic organisms
- o Representative of several taxonomic categories

- o Representative of several ecological habitats; specifically filter-feeding, deposit-feeding, and burrowing
- o Organisms naturally occurring in the San Francisco Bay

The proposed test species are listed in Table 4 and include: the mysid shrimp (*Holmesimysis costata*), a filter or deposit-feeding infaunal crustacean; the marine worm (*Nephtys caecoides*), a burrowing infaunal polychaete; and an Amphipod (*Eohaustorius estuarius*), a filter or deposit-feeding infaunal crustacean for the solid-phase bioassays. The oyster (*Crassostrea gigas*) or bay mussel (*Mytilus edulis*) larvae; the mysid shrimp (*Holmesimysis costata*); and the sand dab (*Citharichthys stigmaes*) will be used in the liquid suspended particulate phase bioassays. The proposed test species were selected from among those recommended by the regulatory agencies as appropriate for use in solid-phase and liquid suspended particulate phase bioassays in the San Francisco Bay Area.

2.3.2 Collection of Test Species

Test species will be obtained from a supplier of aquatic organisms. The following procedures will be utilized in the collection of test organisms. Test species will be collected from a known uncontaminated field location where they occur in sufficient numbers for collection of an adequate sample size (1,500 individuals of each species). The temperature and salinity of the waters from which the test organisms are collected will be measured and recorded. The modified solid-phase bioassay will use 20 individuals of each of the three species to be placed in each replicate tank. The liquid suspended particulate phase bioassay will use 10 individuals of each of the three species to be placed in each replicate tank. Five replicate tanks will be used for each sediment sampling station, for the two reference locations, and for the control station for both the solid-phase and the liquid suspended particulate phase bioassays.

The following materials will be used as necessary collection of the test organisms:

- o Macrophyte net
- o Benthic shovel
- o Sediment sieve - 1.0 millimeter (mm) mesh
- o Water sampler (Van Dorn)
- o Clean holding containers

The test organisms will be collected with a macrophyte net, or with the sediment in which they naturally occur using a benthic shovel, as appropriate. A benthic shovel refers to an attachment to the macrophyte net that prevents organisms from washing under the bottom of the sampler during the collection of organisms. The benthic shovel digs into the substrate increasing collection yield. The organism-containing sediments will be sieved using a 1.0 mm screen. Test organisms will be identified and counted to be sure sufficient numbers have been collected for use in the bioassay. Because the 10-day bioassay test period can represent a major portion of the life-span of the mysid shrimp and other species, an attempt will be made to collect only juvenile forms for use in the bioassay.

Organisms will be gently transferred to holding containers by hand or with pipettes, taking care to prevent contact with fuels, oils, brass, lead, galvanized metal, cast iron, natural rubber or other potentially contaminated areas. Organisms will be placed in holding containers by species, or by compatible species. The holding containers will contain a twenty to thirty millimeter layer of the sieved sediments and several liters of well-aerated seawater from the same location. Following collection, the organisms will be transported to the aquatic bioassay laboratory and transferred to laboratory holding tanks. Because of the

high volume of water required for the laboratory holding tanks, prepared seawater will be used (See Section 2.3.3). Collection and handling of the test organisms will be conducted as rapidly and gently as possible.

2.3.3 Maintenance of Test Species

Upon arrival at the aquatic bioassay laboratory, the organisms will be transferred from the original holding containers to holding tanks, by species or by compatible species. As stated above, holding tanks will contain prepared sea water of the appropriate salinity made from deionized water and artificial sea salts (See Section 2.5). Organisms which require the presence of sediments will be placed in a holding tank containing the sediments in which they were collected and sieved from. The tanks will have a biological filtering system to remove waste materials from the organisms. Continuous bubble aeration will be used to maintain the dissolved oxygen content above the minimum level (See Section 2.6.7). Water salinity and temperature will be monitored by refractometer and continuous temperature recorder respectively. The organisms will be fed every 24 hours; the worm, amphipod and the mussels or oysters will be fed with concentrated algae, the mysid with brine shrimp, and the sand dab with tubifex worms. The food for the organisms will be obtained from a commercial supplier. Holding tanks will be cleaned of leftover food and debris every 24 hours, prior to feeding.

The organisms will be maintained at the same temperature and salinity as the water from which they were collected. Less than 10 percent mortality of organisms (20 percent for zooplankton and larvae) in holding tanks during acclimation period will be necessary for use in the bioassays. Identity of the test organisms will be confirmed by an experienced taxonomist. Because of their greater sensitivity, juvenile forms of the mollusks and large crustaceans will be selected for use in the bioassay where possible. Individual organisms selected for use in the bioassay will have a wet weight less than 3 grams; mollusks will be less than 2 centimeters in length. The bioassay will be initiated within seven to ten days of faunal collections.

2.4 SEDIMENT SAMPLING PROCEDURES

2.4.1 Surficial Sediment Grab Sampling Procedures

Ten grab samples of surficial sediments will be collected from each of the 17 test station areas shown on Plate 3, and from the two reference station areas. A total of approximately 5 sediment grab samples will be collected from the control station area for sediment grain size analysis. The control sample with a grain size that is most comparable to the grain size of sediments from HPA will be used in the control station bioassays. Loran coordinates will be recorded during collection of each representative grab sediment sample within a sampling station area. Grab sediment samples will be discarded if they are low in volume (less than 75% of sampler volume) or contain visible foreign objects. Grab samples will be screened for gamma and beta radiation upon collection with an Eberline E120 portable radiation survey meter with a GM pancake probe. Alpha radiation will be screened with an Eberline 1 portable radiation survey meter with scintillation probe AC3-7. Care will be taken to minimize contamination and alteration of the physical and chemical properties of the sample from freezing, air oxidation, or drying.

The following materials will be needed for collection and storage of sediment samples for use in the bioassay:

- o Noncontaminating sediment grab sampler (Petersen grab)
- o Eberline E120 Radiation Survey Meter with GM Pancake Probe
- o Eberline 1 Portable Radiation Survey Meter with a Scintillation Probe AC3-7

- o Airtight linear polyethylene jars or bags for collection of representative sediment samples to be composited for metal and tributyltin analysis
- o Airtight linear glass jars for collection of representative sediment samples to be composited for SOC, pesticide and PCB analysis
- o 10 liter polyethylene and glass containers for storage and mixing of composited samples
- o Stainless steel stirring rods
- o Clean wide mouth glass jars with teflon screw caps with a minimum volume of 100 mL for collection of sediment samples to be analyzed for SOCs, pesticides and PCBs (one composite sample for each of two analytical methods per station)
- o Clean wide mouth polyethylene jars with a minimum volume of 100 mL for collection of sediment samples to be analyzed for metals and tributyltin (one composite sample for each of two analytical methods per station)
- o Ice chests for preservation and transportation of materials

The ten grab sediment samples from random locations within each test station area (Plate 3) and one grab sediment sample from each reference station (Plate 6) will be obtained using a Petersen grab sampler. The samples will be screened for radioactivity upon collection using the radiation meter. The samples will be placed in airtight polyethylene or glass jars or bags upon collection and sealed until they are composited.

The radioactivity measurements (alpha and beta particles and gamma rays) will be recorded for the control sediment sample and will be considered the background level. Radioactivity measurements recorded for test and reference sediments will be compared to this background level. Should radiation levels of test sediments be above the background level, a non-composited sample will be removed, stored appropriately, and submitted for laboratory testing of radioactivity. Should radiation levels of test sediments be greater than regulatory exposure levels for personal protection, further implementation of the ESAP will be discontinued until appropriate modifications can be made which address the issue of radioactivity at elevated levels. No further action will be taken to address radioactivity if sample levels are within background levels.

Grab sediment samples from within a particular station area will be composited by transferring approximately one liter of sediment from each of the ten representative samples to a separate 10 liter container. Infauna will be screened from the sediment.

When the ten representative samples have all been transferred and the 10 liter container is filled to overflowing, the sediment will be slowly stirred with a stainless steel rod to ensure adequate mixing. Samples for physical and chemical analyses will be removed from each container and the completely filled 10 liter container will be sealed and labeled with the station identification number. The 10 liter container will be stored immediately in an ice chest at 2 to 4^{o}C and maintained at that temperature until analyzed. The modified solid-phase bioassay and liquid suspended particulate phase bioassay will be initiated within seven to ten days of sample collection.

Samples of the composites that will be used for analysis of physical parameters (grain size) will be placed in clean, wide mouth polyethylene or glass containers and labeled with the station identification number. Samples of the composites to be used for chemical analyses will be placed in clean, wide mouth polyethylene or glass jars which will be completely filled to prevent air bubbles, sealed, labeled with the station

identification number, and stored immediately in ice chests at 2 to 4°C and maintained at that temperature until analysis (See Section 2.9). Samples collected for tributyltin analysis will be frozen within 24 hours of collection.

2.4.2 Sediment Core Sampling Procedures

One discrete sediment core sample to a depth of three feet will be collected at each of the 17 test stations shown on Plate 3, and from the two reference station areas. The location of each core sample station will be recorded using Loran C coordinates.

If sediment core samples are low in volume, they will be discarded and the core sample recollected. Core samples will be screened for gamma and beta radioactivity upon collection with an Eberline E120 portable radiation survey meter with a GM pancake probe and for alpha radiation with an Eberline ESP 1 portable radiation survey meter with a scintillation probe. Care will be taken to minimize contamination and alteration of the physical and chemical properties of the sample from freezing, air oxidation, drying, or contact with potential sources of contamination.

The following materials will be utilized for the collection and storage of sediment core samples:

- o Eberline E120 Radiation Survey Meter with GM Pancake Probe
- o Eberline ESP 1 Portable Radiation Survey Meter with Scintillation Probe AC3-7
- o Brass gravity-type core sampler including stainless steel core catchers and nosepiece
- o Cellulose acetate buterate (CAB) core liner tubes
- o Teflon lined core caps
- o Ice chests for preservation and transportation of materials

Sediment core samples will be collected from each station (Plate 3) using a 2-inch gravity-type corer deployed from a boat. Continuous core samples will be collected to a depth of 3 feet below the sediment-water interface. Upon retrieval, the CAB core liner tubes will be extracted from the corer, capped with teflon lined core caps, sealed with tape, labeled and placed on ice in a cooler maintained at 2-4° C. All sampling equipment will be decontaminated prior to and between sampling events by washing with an Alconox detergent solution, followed by a double rinse of tap water followed by distilled water. All proper chain-of-custody protocol will be followed during sample collection and handling as outlined in the QAPjP.

Discrete core samples at the 30 to 36 inch core interval will be extracted from the cores at the laboratory to avoid potential sample contamination in the field. Core samples will be analyzed for metals (EPA Method 6010), semi-volatile organic compounds (EPA Method 8270), pesticides and PCBs (EPA Method 8080) and tributyltin.

2.5 PREPARATION OF SEAWATER FOR BIOASSAY SYSTEMS

The following materials will be needed for preparation of seawater for use in the bioassay:

- o Artificial sea salts (Instant Ocean)
- o Deionized water

- o Polyethylene storage containers of sufficient volume for static-renewal of solid-phase bioassay test tanks

Artificial seawater of approximately the same temperature, salinity, and dissolved oxygen content as water at test organism collection sites will be prepared from artificial sea salts and deionized water. Salinity will be maintained within ± 2‰ and temperature within ± 2° C. Dissolve oxygen will be maintained above 4 ppm.

The prepared artificial seawater will be used in the wet-sieving procedure described below for addition to test tanks used in the modified solid-phase bioassay and for use in the liquid suspended particulate phase bioassay test tanks. Static-renewal of the solid-phase bioassay test tanks will be used with seventy-five percent replacement (See Section 2.6.1.3 for replacement intervals). The volume required will be approximately 10 liters for each solid-phase bioassay tank, approximately 5 liters for each liquid suspended particulate phase bioassay tank, and several additional liters for use in wet-sieving.

2.6 BIOASSAY TESTING PROCEDURES

2.6.1 Modified Solid-Phase Bioassay

2.6.1.1 Sediment Preparation

Just prior to initiation of the bioassay (within 48 hours), preparation of the sediments (solid-phase) will be conducted using the following methods:

- o Sediments will be removed from the interior of the 10 liter composite sample containers
- o Sediments will be wet-sieved through a 0.5 mm mesh screen using a small amount of seawater to remove any remaining live organisms present in the sediment. Water and sediment will be retained in a settling container
- o Material retained by screen will be placed on a sorting tray, organisms will be removed, and the remainder will be returned to settling container
- o Sediment will be allowed to settle for 6 hours, seawater will be decanted without disturbing surface sediment, and sediment will be mixed to ensure homogeneity
- o Sediment will be returned to storage containers and held for approximately 48 hours until needed

2.6.1.2 Organism Preparation

Just prior to initiation of the bioassay the following procedures for the preparation of the organisms will be conducted:

- o Sediments will be gently siphoned and sieved through a 1.0 mm sieve to recapture the organisms from holding tanks containing sediments
- o Organisms will be gently removed from holding tanks containing seawater
- o Damage to the organisms will be avoided by handling with extreme care; organisms which appear damaged or do not meet the bioassay criteria described below will be discarded

- o Specimens of the three species will be randomly divided into finger bowls with water of the same temperature and salinity and from the same source as the water being used in the test so that each contains 20 individuals of each test species (predator and prey organisms will be held in separate bowls)

2.6.1.3 Test Tank Systems

Tanks to be used in the bioassay will have a bottom area not less than 1000 cm^2 and a volume not less than 20 liters. At least five replicate tanks will be used for the control station, the two reference stations and for each of the 17 test stations. More tanks may be used to separate potential predator and prey species.

Prepared seawater of approximately the same temperature, salinity and dissolved oxygen content as water from which the test organism were collected will be used for replacement of static water in tanks. Salinity will be maintained at ± 2‰ and temperature within ± 2° C. Dissolved oxygen will be maintained above 4 ppm. Seventy-five percent of the seawater volume in the tank will be replaced one hour after sediment has been added to tanks and at 48 hour intervals after that using gentle siphoning and water introduction techniques. The frequency of replacement will be increased if acceptable water quality cannot be maintained.

2.6.1.4 Introduction of Seawater and Sediments to Test Tanks

Addition of seawater and sediments to test tanks will involve the following procedures:

- o Each tank will be partially filled with seawater
- o Enough sediment will be added (reference sediment to reference tanks and test sediments to test tanks) to produce an even 45 mm layer on the bottom
- o Each tank will be allowed to stand for at least one hour
- o Seventy-five percent of seawater volume in tank will be replaced using gentle siphoning and addition techniques prior to addition of organisms

2.6.1.5 Introduction of Organisms to Test Tanks

Following preparation and selection of individual organisms for use in the bioassay, the selected organisms will be released from the finger bowls to the tanks. Potential predator and prey organisms will be placed in separate tanks.

2.6.1.6 Initiation of Bioassay

The bioassay will begin with the introduction of organisms to the test tanks. Daily records will be kept of the following observations:

- o Obvious mortalities (will be removed from tank)
- o Formation of tubes or burrows
- o Unusual behavioral patterns such as burrowing species not burrowing

Daily levels of the following water parameters will be measured and recorded:

- o Salinity of tank water
- o Temperature of tank water
- o Dissolved oxygen content of tank water
- o pH of tank water

Gentle aeration will be used to maintain the dissolved oxygen content above 4 parts per million (ppm) (EPA/COE, 1990). Lighting for the bioassay tanks is provided by fluorescent bulbs on a timer to simulate natural conditions.

2.6.1.7 Completion of Solid-Phase Bioassay

After 10 days, the tank sediments will be siphoned through a 0.5 mm screen. The material retained on the screen will be mixed with seawater and searched thoroughly for organisms. The organisms will be considered alive if they show any response to the gentle probing of sensitive parts. The number of live organisms will be counted and recorded. Sublethal effects such as paralysis will be recorded as mortalities if the test organism fails to respond to gentle probing.

Care will be taken not to count exoskeletons as dead organisms. Organisms which are not recovered will be considered dead because once dead, organisms may decompose or be predated.

2.6.1.8 Presentation of Data

If control mortality is greater than 10 percent, the results of the bioassay will be considered invalid. However, statistical analysis may be used to determine the acceptability of control mortality greater than 10 percent. The 1990 EPA/COE manual states that "unacceptably high control mortality indicates that the organisms are being affected by important stresses other than contamination in the material being tested (i.e. injury, disease, unfavorable chemical or physical conditions in test containers, improper handling or acclimation, or unsuitable grain size". In this event, species selection or other variables will be re-evaluated and the test repeated. If control mortality is acceptable, the bioassay data will be presented in tabular form and will include the following information:

- o Scientific name of selected test species
- o Number of animals seeded
- o Percent of animals recovered alive
- o Statistical analysis of data if required to determine the acceptability of control mortality

2.6.1.9 Statistical Analysis and Interpretation of Results

If control mortality is less than 10 percent (i.e. greater than 90 percent survival), survival of individual species will be statistically analyzed using the same tests as the combined survival of all three test species. An analysis of variance (ANOVA) will be used to compare the mean control and test survivals but must be preceded by Levine's test for the homogeneity of variances. If Levine's test for the homogeneity of variances

shows that the hypothesis of equal variances for the analysis of variances (ANOVA) is rejected, then Steels' Many One-Rank test or the Wilcoxin Rank Sum test with Bonferri Adjustment will be utilized. Other statistical analysis of data will be considered where appropriate.

A statistically significant effect in a bioassay does not necessarily imply that the same impact would occur in the field. There is no quantitative method for estimating ecological effects in the field from the results of a bioassay. Statistical analysis of benthic bioassay data will be conducted to determine the 'strength of evidence' for concluding that the test samples are significantly more toxic to marine benthic infauna than are the control sediment samples. However, differences between control and test survival should be 10 percent or greater before predictions of probable field impact can be made (EPA/COE, 1990).

2.6.2 Liquid Suspended Particulate Phase Bioassay

2.6.2.1 Sediment-Water Preparation

Prior to initiation of the liquid suspended particulate phase bioassay, preparation of the sediment-water mixture will be conducted using the following methods:

- o One liter sediment subsamples will be removed for each of the composite sample containers
- o The sediments will be combined with prepared artificial seawater in a volumetric sediment-to-water ratio of 1:4 at room temperature (22° ± 2° C)
- o The sediment-seawater mixture will be thoroughly mixed for 30 minutes
- o The mixture will then be allowed to settle for 1 hour
- o The liquid and sediment remaining in suspension after 1 hour will be siphoned off, taking care not to disturb the settled material, for immediate use in the bioassay.

2.6.2.2 Organism Preparation

Just prior to initiation of the liquid suspended particulate phase bioassay, the following procedures will be conducted:

- o From holding tanks containing seawater, organisms will be gently removed by pipette. Larger organisms will be transferred in fine-mesh nets.
- o Damage to the organisms will be avoided by handling with extreme care; organisms which appear damaged or that exhibit abnormal behavior will be discarded
- o Specimens of the three species of approximate equal size will be randomly divided into test containers so that each contains 10 individuals of each test species.

2.6.2.3 Test Tank System

Tanks to be used in the liquid suspended particulate phase bioassays will have a volume of at least 5 liters. At least five replicate tanks will be used for the control station, the two reference stations and for each of the 17 test stations. More tanks may be used to separate potential predator and prey species.

Prepared seawater of approximately the same temperature, salinity and dissolved oxygen content as the water from which the test organisms were collected will be used for the sediment-water mixture. Salinity will be maintained at ± 2‰ and temperature at ± 2° C. A dissolved oxygen content of 4 ppm or greater will be maintained throughout the tests.

Three concentrations of test material suspension will be tested at concentrations of 100, 50, and 10 percent.

2.6.2.4 Introduction of Seawater-Sediment Mixture to Test Tanks

The 4 : 1 sediment-water mixture will be introduced to the test tanks immediately upon completion of the sediment/water preparation procedures described in Section 2.6.2.1.

2.6.2.5 Introduction of Organisms to Test Tanks

Following preparation and selection of individual organisms for use in the bioassay, the organisms will be released to the tanks. Potential predator and prey organisms will be placed in separate tanks.

2.6.2.6 Initiation of Liquid Suspended Particulate Phase Bioassay

The bioassay will begin with the introduction of organisms to the test tanks. The test duration will be 48 hours for bivalve larvae and 96 hours for the mysid shrimp and sand dab.

At 0, 4, 24, 48, 72 and 96 hours, the number of live organisms will be recorded. An organism will be considered dead if it does not respond to the probing of a sensitive body part and will be removed from the test tank. In addition, any behavioral abnormalities exhibited by test organisms will be recorded. At each observation period, dead organisms, molted exoskeletons and food debris will be removed from the tanks by pipette or forceps.

Daily levels of the following water parameters will be measured and recorded:

- o Salinity of tank water
- o Temperature of tank water
- o Dissolved oxygen content of tank water
- o pH of tank water

The tank water will be aerated only when necessary to maintain the dissolved oxygen content above 4 parts per million (EPA/COE, 1990).

2.6.2.7 Completion of Bioassay

After 48 hours, the tank water containing the bivalve larvae will be searched thoroughly for organisms. The organisms will be considered alive if they show any response to the gentle probing of sensitive parts or gently swirling of the water. The number of live organisms will be counted and recorded. After 96 hours, the same procedures will be performed on the tank test water containing the mysid shrimp and sand dab.

2.6.2.8 Presentation of Data

If control mortality is greater than 10 percent (20 percent for zooplankton and larvae), the results of the bioassay may not be evaluated. In this case, species selection and other test variables will be reevaluated in an attempt to reduce unacceptably high control mortality. If control mortality is less than 10 percent, the bioassay data will be presented in tabular form and will contain the following information:

- o Scientific name of test species
- o Number of organisms in each treatment at test start
- o Number of organisms alive at each observation period
- o Number of organisms recovered alive at test end
- o Any behavioral abnormalities recorded

2.6.2.9 Statistical Analysis and Interpretation of Results

If control mortality is less than 10 percent (20 percent for larvae) and is less than the mortality in the test material treatment, the test data will be statistically analyzed to determine if there is a significant difference in survival between control and test samples. The t-test (Snedecor and Cochran, 1980) will be used to compare the mean control and test survivals following the Levene's test for the homogeneity of sample variances is performed.

If mortality in the test material exceeds 50 percent, an LC50 value (lethal concentration to 50 percent of the sample) will be calculated for any dilutions in which greater than 50 percent mortality occurs.

In the event that no mortality occurs in either control or test tanks, or that survival of organisms in the test tanks is equal to or greater than control organism survival, no statistical analyses will be performed (EPA/COE, 1990).

2.7 CHEMICAL ANALYSIS CONFIRMATION

Chemical analysis will be conducted on composite surficial samples and a discrete sediment core sample from each test station to provide information regarding contaminants in the sediments that, if present and biologically available, could cause toxicity. Collection, preservation, and storage of the sediment samples which may be used for analysis is described in Section 2.4. The analytical program is presented in Table 3.

The sediment samples will be analyzed for both inorganic and organic constituents. A list of the analytical methods, analyte list, and approximate quantitation limits are presented in Table 5. The classes of target chemicals for analysis include inorganics, pesticides and PCBs, SOCs, and tributyltin. As described in the Quality Assurance Project Plan (QAPP) (HLA, 1988f) these analyses will be performed in accordance with the procedures outlined in the EPA Contract Laboratory Program (CLP) Statements of Work (SOWs) (EPA, 1988a,b). If CLP detection limits exceed sediment contaminant levels associated with adverse biological effects (ER-L values), lower detection limits will be used when possible.

Sediment samples will be sent to certified CLP laboratory(s) immediately following collection where they will then be split in preparation for the various chemical analyses. The laboratory(s) will also be certified by the State of California Department of Health and Human Services and the Naval Energy and Environmental Support Activity.

Sediment analysis for metals will utilize inductively coupled plasma (ICP) by EPA Method 6010, with the exception of arsenic (EPA Method 7060), total lead (EPA Method 7421), selenium (EPA Method 7740) and thallium (EPA Method 7841) to be analyzed by furnace atomic absorption methods, and mercury by cold vapor AA (EPA Method 7470). Semi-volatile organic compounds will be analyzed by EPA Method 8270 and pesticides and PCBs by EPA Method 8080.

Tributyltin will be analyzed by n-pentyl derivitization with gas chromatography/flame photometric detection (GC/FPD). This method requires that the samples be frozen within twenty-four hours of collection. Holding times have not yet been specified but EPA recommends that the analysis be performed as soon as possible to prevent potential degradation of the sample.

2.8 QUALITY ASSURANCE SUMMARY

Provisions for quality assurance will be made where applicable and specifically in the following areas:

- o Organisms selected for use in the bioassay will be undamaged and positively identified to species
- o Laboratory and bioassay temperature control equipment will be adequate to maintain required test temperature
- o Instruments used for measurement of test parameters will be calibrated and standardized.
- o Sediment will be collected from a control location and processed through the bioassay in five replicates to provide a basis for quality assurance
- o A 10 percent or greater average control mortality (less than 90 percent survival) will invalidate the bioassay results; because the 10-day bioassay test period can represent a major portion of the life span of the mysid shrimp and other species, and result in mortality greater than 10 percent from natural causes, an attempt will be made to collect only juvenile forms for use in the bioassay
- o Field quality assurance/quality control (QA/QC) sample types will include external spikes, blanks, and duplicates as described in the QAPjP
- o All chemical analyses will be performed by a laboratory certified by the State of California, the EPA (CLP Laboratory), and the Navy for the specific analyses requested, as applicable.

3.0 TASK 2 - EVALUATION OF WHETHER PERSISTENT AND BIOACCUMULATIVE SUBSTANCES MAY BE ENTERING THE SAN FRANCISCO BAY FROM HPA

3.1 STATEMENT OF PURPOSE

The ESAP identifies the procedures to be used for the evaluation of persistent and bioaccumulative substances which may be present in the waters surrounding HPA above background levels. Certain substances present in the groundwater and soil at HPA from past activities are of concern due to their physical persistence and potential for seepage into the San Francisco Bay at concentrations not detectable in the water column itself. The proposed sampling and analytical program is presented in Table 3. Specific substances of concern to be analyzed and their expected reporting limits are presented in Table 6 and include: metals, SOCs, organochlorine pesticides and PCBs, and tributyltin.

The potential presence of these substances in the San Francisco Bay surrounding HPA, and their potential for bioaccumulation into aquatic organisms will be evaluated by measuring the chemical uptake of these substances into the mussel, *Mytilus californianus*. Mussels collected from an uncontaminated area in Bodega Head will be transplanted in the waters surrounding HPA and collection and subsequent chemical analysis of the mussel tissues will provide an indication of which potential persistent and bioaccumulative substances are present.

Two 30-day mussel deployment tests will be conducted; one in April or August/September to assess potential bioaccumulative effects during dry weather conditions, and one in January/February to assess wet weather condition potential bioaccumulative effects. The May-June mussel spawning period will be avoided in order to maximize mussel bioaccumulative potential. The protocol and methodologies employed in the two mussel deployment test periods will otherwise be identical.

Because low levels of radioactivity have been reported at HPA (HLA, 1990a), all mussel tissue samples will be screened for alpha, beta and gamma radioactivity upon collection (See Section 3.5). Radioactivity measurements will be compared to the background level measured for control mussel tissue. Should the results of this radioactivity screen show counts greater than background, additional samples will be collected and submitted to a radiation-certified analytical laboratory for analysis of radioactivity. Should the results of the radioactivity screen show levels greater than regulatory exposure levels, further implementation of the ESAP will be discontinued until appropriate modifications can be made which address the issue of radioactivity at these elevated levels. No further action will be taken to address radioactivity if sample levels are within background levels.

Collection, deployment, preparation and analytical procedures to be used are based on the "State Mussel Watch Protocol: Procedural Guidelines for Sampling, Analyzing, and Reporting Trace Metal and Synthetic Organic Concentrations in Marine Mussels", Appendix D of "California State Mussel Watch 1983-84" State Water Resources Control Board, Water Quality Monitoring Report No. 85-2WQ, 1985, and the "California State Mussel Watch 1986-1987" State Water Resources Control Board, Water Quality Monitoring Report No. 88-3, July, 1988.

Because the SMW procedures are designed for a long-term monitoring study used to identify trends in toxic pollutants (SWRCB 1985, 1988), certain modifications were necessary to address the short-term qualitative focus of this mussel study; i.e. the *presence* of persistent and bioaccumulative substances from HPA. Modifications to specific procedures are discussed in the appropriate sections.

3.2 SELECTION OF MUSSEL TRANSPLANT STATIONS

The following criteria were considered in the selection of proposed mussel transplant stations for HPA:

- Proximity to areas of known or potential contamination, specifically IR and PA sites and UST locations identified in previous investigations
- Areas closer to shoreline than sediment sampling stations to address potential groundwater seepage, direct surface water runoff, and/or discharge from storm sewer outfalls
- Past historical shoreline and berth uses
- Areas of little or no influence from potential sources of contamination other than HPA
- Accessibility for transplant and retrieval of mussels

The proposed mussel transplant stations were all considered to be accessible transplant and retrieval areas near potential sources of contamination at HPA. The stations were placed along the coastal perimeter of HPA from north to south, in proximity to the HPA areas of known and potential contamination described in Table 1 and the status of confirmed USTs is summarized in Table 2. The 17 proposed mussel transplant stations and associated areas of known or potential contamination are listed below and shown on Plate 4. These locations are approximate and may be changed as more information regarding the hydrogeology of HPA is obtained from the RIs or UST investigations.

Station Number	Associated Site(s)	Outfall Areas
M-1	IR-7, PA-18	B
M-2	IR-6, IR-10	C
M-3	IR-6, IR-10	D
M-4	IR-6	---
M-5	IR-9	G,H,I,J
M-6	IR-8, IR-9	---
M-7	PA-16, IR-17	---
M-8	IR-11, IR-15, PA-16, IR-17	A
M-9	IR-2, IR-11, IR-15	---
M-10	IR-2, IR-3, IR-8, IR-11, IR-14, IR-15	---
M-11	IR-2, IR-5, IR-12, IR-13	---
M-12	IR-2, IR-4, IR-5, IR-12	---
M-13	IR-1, IR-4	---
M-14	IR-1	---
M-15	Dry Dock # 2	---
M-16	Dry Dock #3	E,F
M-17	Dry Dock #4	---

In addition, mussels will be deployed at three reference stations located in San Francisco Bay as indicated on Plate 7.

The SWRCB (1985, 1988) SMW reports describe procedures used for the transplant to, and retrieval of mussels from, sites throughout the San Francisco Bay. The focus of the SMW Program has changed from "clean" sites to problem areas (SWRCB, 1985), but no particular guidance is provided regarding the placement of mussel transplant stations in areas of potential contamination.

3.3 SELECTION OF TEST SPECIES

The following criteria were considered in the selection of test species for use in this mussel study:

- o Ease of collection; availability from an uncontaminated area
- o Ease of transplant
- o Native to Northern California
- o Can be used in bays and estuaries

The proposed test species is the California mussel, (*Mytilus californianus*) as presented in Table 4. Only healthy, non-spawning mussels will be used as test organisms.

3.4 DETERMINATION OF SIZE OF TEST POPULATION

Because no statistical analysis is necessary for determination of the presence of chemicals in tissue, the size of the test population is dependent on the number of mussel deployment stations, the number of mussels required for each analysis, and the number of analyses to be completed.

Each mussel deployment station will have a sample size of 50 (15 composited individuals for a single analysis of trace metals, 20 composited individuals for a single analysis of organic compounds, 5 composited individuals for field screening of radioactivity, and 10 individuals to compensate for potential mortality among the test mussels). Subsequent laboratory testing of radioactivity will be conducted should levels be above the established background radioactivity level (See Section 3.5). The use of composited samples and the numbers of composited individuals used for the respective analyses are consistent with the SMW Program (SWRCB, 1988). The 20 composited individuals is the minimum for analysis of organic compounds. For statistical purposes, the SMW program uses three replicates of 15 composited individuals for trace metal analysis (SWRCB, 1988).

3.5 COLLECTION OF MUSSELS FROM UNCONTAMINATED AREA

Tissue concentrations of certain metals and organics show a distinct correlation with the size of the mussel; concentrations decrease with increasing mussel size. Mussels collected for transplant will be between 55 and 65 mm in length which is the standard size used by the SMW Program (SWRCB, 1988). The mussel shell length will be measured and recorded upon collection for size requirement verification and for later determination of visible growth following mussel deployment. The habitat height of the mussels, with respect to mean low tide, can be another source of tissue concentration variability. In keeping with SMW procedures (SWRCB, 1988), the mussels for transplant will be collected from the highest tidal height where they can be found in sufficient numbers.

The closest source of transplant mussel stock used by the SMW Program is Bodega Head (SWRCB, 1988). Because this is public property, mussels will be collected in the Bodega Head area. Enough mussels will be collected for transplanting to test and reference stations as well as analyses of a background sample of mussels from the collection area.

The following materials will be needed for collection of mussels for immediate analysis to establish background radioactivity level and background body burden and provide a basis for quality assurance:

- o Eberline E120 Radiation Survey Meter with GM Pancake Probe

- o Eberline ESP 1 Portable Radiation Survey Meter with a Scintillation Probe AC3-7
- o Polyethylene ZIPLOCK^R bags (4 mm thickness) cleaned with the detergent MICRO^R and thoroughly rinsed with deionized water prior to use
- o Aluminum foil bags (constructed from two layers of "heavy duty" aluminum foil) cleaned by heating to 500^{O}C or by rinsing in hexane prior to use
- o Polyethylene ZIPLOCK^R bags
- o Black grease pencils
- o Non-metallic ice chests containing dry ice

A group of 15 individual mussels to be analyzed for metals will be placed in pre-cleaned polyethylene ZIPLOCK^R bags. These bags will then placed inside two additional polyethylene ZIPLOCK^R bags. A group of 20 individual mussels to be analyzed for organics will be placed in pre-cleaned aluminum foil bags which will then be double-bagged with polyethylene ZIPLOCK^R bags. A group of 5 individual mussels will be opened, screened for radioactivity using a radiation meter, and placed in pre-cleaned polyethylene ZIPLOCK^R bags for laboratory testing of radioactivity.

Using black grease pencils, the outer bags will be clearly marked with program identification, station identification number, site description, depth of water, date of collection, species, type of analysis to be performed, and the initials of the collector. Samples will be placed in ice chests containing dry ice, quickly frozen, and stored at or below -20^{O}C until preparation and analysis (See Sections 3.8 and 3.9).

The following materials will be needed for collection of mussels for transplant to the test and reference stations:

- o Clean nylon mesh bait bags (76 mm x 760 mm with 1/2 inch square mesh) washed with detergent and rinsed with deionized water prior to use
- o Nylon cable ties
- o Non-metallic ice chests (unfrozen)

Mussels will be collected in the field using the criteria presented above. They will be added to the nylon mesh bait bags in groups of 7-8 individuals. The groups will be separated by constricting the bag with nylon cable ties which permits equal water exposure for all the mussels. The mussel-filled bags will tied off with nylon cable ties and placed in the unfrozen ice chests and held for no longer than 48 hours before deployment. Care will be taken to avoid contamination.

3.6 DEPLOYMENT OF COLLECTED MUSSELS

The following materials will be needed for deployment of collected mussels:

- o Polyethylene gloves
- o Polyethylene ZIPLOCK^R bags

- Nylon cable ties
- Buoy systems (described below)

Collected mussels will be stored in unfrozen ice chests for no longer than 48 hours prior to deployment in the field. Field precautions will be taken to avoid contamination from sources such as boat exhaust. Polyethylene gloves will be worn during deployment of mussels. Mussels in mesh bags will be placed in polyethylene bags from the time they are removed from the ice chests until they are deployed.

Loran coordinates will be recorded to identify deployment locations. Mesh bags containing mussels will be attached with nylon cable ties and deployed in shallow water (less than 90 meters in depth) on a securely anchored buoy system. The buoy system will consists of an earth anchor, a polypropylene line or a cable, and an inflatable subsurface float.

The transplant period will be a minimum of 30 days based on American Society for Testing and Materials (ASTM) standard practice for bioconcentration tests which uses fish and bivalve mollusks and requires an exposure duration of at least 28 days (ASTM, 1988). Exposure periods much greater than 30 days may produce significant artifacts in the tissues which would mask the potential chemical releases being investigated at HPA. The SMW Program uses transplant intervals of from two to six months due to the monitoring objectives of their study (SWRCB, 1988).

3.7 RETRIEVAL AND STORAGE OF TRANSPLANTED MUSSELS

The following materials will be needed for retrieval and storage of transplanted mussels:

- Polyethylene gloves
- Eberline E120 Radiation Survey Meter with GM Pancake Probe
- Eberline ESP 1 Portable Radiation Survey Meter with a Scintillation Probe AC3-7
- Polyethylene ZIPLOCK^R bags
- Polyethylene ZIPLOCK^R bags (4 mm thickness) cleaned with the detergent MICRO^R and thoroughly rinsed with deionized water prior to use
- Aluminum foil bags (constructed from two layers of "heavy duty" aluminum foil) cleaned by heating to 500^{o}C or by rinsing in hexane prior to use
- Black grease pencils
- Non-metallic ice chests containing dry ice

Retrieval from the subsurface buoy system will occur after the 30 day transplant period has elapsed. Polyethylene gloves will be worn during all phases of retrieval and storage. All mussel samples will be placed in polyethylene bags before being brought to the air/water surface.

Once brought to shore, the samples to be used for metals analysis will be placed in pre-cleaned ZIPLOCK^R polyethylene bags (4 mm thick). This bag will then be placed inside two additional polyethylene ZIPLOCK^R bags. Samples to be analyzed for organics will be placed in pre-cleaned aluminum foil bags which will then be double-bagged with polyethylene ZIPLOCK^R bags. Samples to be screened for radioactivity will have the shells opened to allow screening of tissues. The gullets will be sliced open to expose the GI tract contents.

Radioactivity measurements will be recorded and samples will be placed in pre-cleaned ZIPLOCK^R polyethylene bags for potential laboratory testing of radioactivity.

Using black grease pencils, the outer bags of all samples will be clearly marked with program identification, station identification number, site description, depth of water, date of collection, species, type of analysis to be performed, and the initials of the collector. Samples will be placed in the ice chests containing dry ice, quickly frozen, and stored at or below -20^{o}C until analysis.

3.8 PREPARATION OF MUSSEL TISSUES FOR ANALYSES

3.8.1 Preparation of Tissues for Metals Analyses

The preparation of mussel tissues for metals analyses will be conducted under minimal contamination conditions. The equipment and glassware cleaning procedure recommended for metals analyses by the SMW Program (SWRCB, 1988) will be used and is presented in Appendix B.

The following materials will be needed for dissection and homogenation of mussels for metals analyses:

- Polyethylene gloves
- Deionized water
- Polyethylene trays
- Stainless steel scalpels (cleaned with MICRO^R prior to use)
- Polypropylene jars (4 ounce, acid-cleaned and preweighed)
- Metric ruler
- Homogenizing flasks (acid-cleaned)
- Homogenizer (with stainless steel shaft and blade cleaned with hot nitric acid (HNO_3) and rinsed with deionized water)

The following procedures for dissection and homogenation of mussels for metals analyses will be employed:

- All handling of mussels during preparation will be conducted wearing polyethylene gloves
- Frozen mussels will be removed individually from ZIPLOCK^R bags and cleaned of epiphytic organisms and debris under running deionized water
- Mussels will be placed on clean polyethylene trays and allowed to thaw
- The adductor muscle will be severed and gonads removed with a clean stainless steel scalpel
- Remainder of soft part of mussel will be placed in polyethylene jar and weighed
- Shell will be measured and any visible growth of transplanted mussels noted

- Soft part will be transferred to homogenizing flask and homogenized for three minutes
- Homogenized sample will be refrozen and stored at-20°C until analysis

Note that gonads will be removed from samples intended for metals analyses because concentrations of metals in gonads vary with organism sex (Alexander and Young, 1976; Gordon et al, 1978; Stephenson et al, 1987)) and with mass of gonad (Ouellette, 1978). This practice is employed by the SMW Program (SWRCB, 1988).

3.8.2 Preparation of Tissues for Organic Analyses

The preparation of mussel tissues for organic analyses will be conducted under minimal contamination conditions. The equipment and glassware cleaning procedure recommended for organic analyses by the SMW Program (SWRCB, 1988) will be used and is presented in Appendix B.

The following materials will be needed for dissection and homogenation of mussels for organic analyses:

- Polyethylene gloves
- Deionized water
- Sheets of hexane-rinsed aluminum foil
- Stainless steel scalpels (cleaned with MICRO^{R} detergent prior to use)
- Glass jars (4 ounce, acid-cleaned and preweighed)
- Metric ruler
- Homogenizing flasks (acid-cleaned)
- Homogenizer (with stainless steel shaft and blade cleaned in hot HNO_3 and rinsed with deionized water)

Mussels will be dissected and homogenized using the same procedures described in Section 3.8.1 with the following exceptions:

- Thawing and dissection will be conducted on sheets of hexane-rinsed aluminum foil
- Gonads will not be removed (will be included in analyses)
- Soft parts will be placed in clean glass jars

3.9 PREPARATION OF SAMPLES AND ANALYSES

CLP requirements are not applicable for the analysis of tissue, therefore, the methods identified below will be used for analysis of the mussel tissues.

3.9.1 Preparation of Samples and Metals Analysis

Sample digestion prior to analysis of metals other than mercury will be conducted following procedures used by the SMW Program (SWRCB, 1988) (See Appendix C). Sample digestion and analytical procedures for mercury are described below.

Analysis of the metals listed above will be conducted using the inductively coupled argon plasma (ICP) instrumentation, EPA Method 6010, with the exception of selenium, arsenic, total lead and thallium which cannot be analyzed by ICP methods and will be analyzed by graphite furnace atomic absorption (AA) (EPA Method 7000 series). The expected reporting limits are presented in Table 6. This analytical procedure differs from those used by the SMW Program (SWRCB, 1988). The SMW Program utilizes either flame AA or graphite furnace AA methodology (EPA Method 7000 series) for metal analysis with the exception of mercury which is analyzed by cold vapor AA. However, due to the increased number of metal analytes in the ESAP, the ICP was considered as a more appropriate methodology.

3.9.2 Preparation of Samples and Mercury Analysis

Sample digestion prior to analysis of mercury will be conducted following procedures used by the SMW Program (SWRCB, 1988) (See Appendix C). The Stainton (1971) syringe procedure used by the SMW Program, or a similar procedure, will be used for the transfer of nanogram quantities of mercury vapor for analysis by AA spectrophotometry (See Appendix C).

The cold vapor AA technique, EPA Method 7471 (EPA, 1986), will be used for analysis of mercury based on the standard nature and commercial availability of this method. The expected reporting limit is presented in Table 6. The SMW Program (SWRCB, 1988) uses flameless AA techniques similar to the selected method. Analysis of mercury for the SMW Program is conducted at the California State University's Moss Landing Marine Laboratory which will be considered for an inter-laboratory calibration.

3.9.3 Preparation of Samples and Organic Analyses

Homogenized samples will be extracted for organic analyses according to procedures of the Food and Drug Administration (FDA) (1970) which are used by the SMW Program (SWRCB, 1985) (See Appendix C).

The samples will be analyzed for the presence of SOCs by GC/MS techniques, EPA Method 8270 (EPA, 1986), and for the presence of organochlorine pesticides and PCBs by ECD and GC techniques, EPA Method 8080 (EPA, 1986). The expected reporting limits are presented in Table 6. These analytical methods are similar to those used by the SMW Program (SWRCB, 1988).

3.9.4 Preparation of Samples and Tributyltin Analysis

Homogenized samples will be extracted for analysis of tributyltin according to the procedures used by the SMW Program (SWRCB, 1988) (See Appendix C).

The samples will be analyzed for the presence of tributyltin by n-pentyl derivitization followed by gas chromatography/flame photometric detection (GC/FPD). The expected reporting limit is presented in Table 6. This method differs from that used by the SMW Program (SWRCB, 1988).

3.10 PRESENTATION OF DATA

A list of constituents detected by the particular methods and expected reporting limits are presented in Table 6. Results of metals and organic analyses will be presented in tabular form.

3.11 QUALITY ASSURANCE SUMMARY

Provisions for quality assurance will be made where applicable and specifically in the following areas:

- Most proposed procedures follow those employed by the SMW Program (SWRCB, 1988); the number of individuals to be pooled for composite samples is within the ranges used by the State Program although the use of one replicate instead of three for metals analyses is a modification based on the objective of determining the presence of chemicals versus statistical differences

- Mussels will be collected from the uncontaminated area, pooled in the appropriate numbers and stored at the appropriate temperature prior to analysis; the analysis will establish background body burden and provide a basis for quality assurance

- Analysis of most metals will be conducted using ICP instead of AA techniques; analysis of organics will be accomplished using GC/MS instead of GC where possible to provide a greater degree of accuracy

- All chemical analyses will be performed at qualified analytical laboratories which maintain the documentation necessary for appropriate QA/QC

4.0 TASK 3 - EVALUATION OF STORM WATER RUNOFF TOXICITY

4.1 STATEMENT OF PURPOSE

The ESAP establishes the procedures to be used for the evaluation of the potential toxicity of storm water runoff from HPA. This will be accomplished using chronic bioassay techniques on three appropriate species. Chronic bioassay testing is more sensitive than acute toxicity testing and will address potential toxic effects of exposure to HPA storm water runoff.

Encroachment of bay water to the HPA storm sewer system was identified by HPA personnel following the Loma Prieta earthquake on October 17, 1989 (WESTDIV, 1990). Therefore, the salinity of waters within the storm sewer system could potentially be higher than might normally be expected. Storm water salinity will be measured in the field by refractometer at the time of sample collection. The species selected for use in the chronic bioassays will be those considered most appropriate for the salinities encountered. If higher storm water salinities are measured, estuarine or marine species, with a tolerance for salinity will be utilized, as opposed to the freshwater species commonly used for this type of effluent toxicity testing.

Collection of storm water samples for use in the chronic bioassays will be conducted concurrently with the storm water sampling outlined in the Proposed Reconnaissance Study of Stormwater Quality, Hunters Point Annex (HLA, 1988g) and will allow direct comparison between toxicity data and chemical data for specific storm water sampling points. Collection of bay water samples for use in the chronic bioassays will be conducted to provide a basis for comparison with the storm water samples. The proposed sampling and analytical program is presented in Table 3.

The following procedures are based on "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms", Weber, C.I., Horning, W.B., et al, eds., Environmental Monitoring and Support Laboratory, Cincinnati, Office of Research and Development, EPA/600/4-87/028, May, 1988 or "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", Horning, W.B., II and Weber, C.I., eds., Environmental Monitoring and Support Laboratory, Cincinnati, Office of Research and Development, EPA/600/4-85/014, December, 1985. The methodologies are the same as those employed by the San Francisco Regional Water Quality Control Board (RWQCB) for dischargers for effluent toxicity under the NPDES program.

4.2 SELECTION OF SAMPLING POINTS

4.2.1 Selection of Storm Water Runoff Sampling Points

The following criteria were considered in the selection of proposed storm water runoff sampling points for HPA:

- Proximity to or contribution of discharge from areas of known or potential contamination, specifically IR and PA sites identified in previous investigations
- Known discharge point identified by WESTDIV in their letter regarding status of stormwater sampling (WESTDIV, 1990)
- Representative of "worst-case" storm water runoff from past activities at HPA
- Accessibility for collection of adequate quantities of storm water for use in the chronic bioassays

The proposed storm water runoff sampling points for the ESAP are accessible and are the same as those already used for the reconnaissance study of stormwater quality (WESTDIV, 1990). The sampling points are each located in a separate storm water drainage area and, with the exception of location ST4, are considered to be in proximity to or have contribution from the HPA areas of known and potential contamination described in Table 1. Sampling point ST4 is located where alleged discharge of industrial waste was reported to have occurred in the past. The four proposed storm water runoff sampling points and associated areas of known or potential contamination are listed below and shown on Plate 5.

Station Number	Associated Site(s)
ST1	IR-6, IR-10
ST2	IR-9
ST3	IR-1, IR-2, IR-3, IR-4, IR-5, IR-11, IR-12, IR-13, IR-14, IR-15, IR-17
ST4	Previous Industrial Discharge

The effluent sampling point used for collection of water for the chronic bioassays should usually be the same as that specified in an NPDES discharge permit (EPA, 1985). No particular guidance is provided regarding the selection of storm water runoff sampling points for use in chronic bioassay testing.

4.2.2 Selection of Bay Water Sampling Points

The following criteria were considered in the selection of proposed bay water sampling points for HPA:

- Point of bay water encroachment to the HPA storm sewer system (outfall location)
- Accessibility for collection of large quantities of bay water for use in the chronic bioassays

The proposed bay water sampling points for the ESAP are accessible points of bay water encroachment to the HPA storm sewer system. The four proposed bay water sampling points and associated storm water runoff sampling points are listed below and shown on Plate 5.

Station Number	Associated Runoff Station
B-1	ST1
B-2	ST2
B-3	ST3
B-4	ST4

The bay water samples will provide a basis of comparison for the storm water samples.

4.2.3 Selection of Reference Water Sampling Point

The following criteria were considered in the selection of the proposed reference water sampling point:

- Area of little or no known contamination based on history and knowledge of the area
- Area out of the tidal influence of HPA; to be determined from review of NOAA tidal maps, if necessary
- Area containing water of the same or similar salinity as the receiving waters at HPA

The proposed reference water sampling point is San Pablo Bay. San Pablo Bay is considered to be an uncontaminated area out of the tidal influence of HPA with an expected salinity similar to the receiving waters at HPA (estuarine). The reference water sample will be collected and prepared for use in the reference bioassays to simulate the encroachment of bay water to the HPA storm sewer system and presence in storm water samples (See Section 4.4.3).

4.3 SELECTION OF TEST SPECIES

The following criteria were considered in the selection of test species for use in the chronic bioassays:

- o Appropriately sensitive species
- o Representative of several taxonomic categories
- o Representative of several ecological niches
- o Commonly used for chronic bioassay testing

As indicated in Table 4, the species selected for use in the chronic bioassays are: *Pimephales promelas*, fathead minnow; *Ceriodaphnia dubia*, cladoceran: and *Selenastrum capricornutum*, freshwater algae. If field storm water salinity tests indicate the use of marine species to be more appropriate, the following species will be used in the bioassays: *Menidia beryllina*, inland silversides: *Dendraster excentricus*, the sand dollar; and *Skeletonema costatum*, a marine algae. *Strongylocentrotus purpuratus*, the sea urchin may be substituted for the sand dollar, depending on the time period in which the bioassay tests are conducted. The three selected test species are all commonly used in the San Francisco Bay region for assessment of chronic toxicity.

4.4 COLLECTION AND PREPARATION OF WATER FOR BIOASSAY SYSTEMS

4.4.1 Collection of Composite Storm Water Runoff Samples

Collection of storm water runoff samples will take place as soon as possible within the first significant storm event of the rainy season. A composite sample of storm water will be manually collected over an 8-hour period (at the rate of 10 liters every hour) at each runoff sampling point to provide an indication of the average quality of the effluent over the sampling period. One suite of bioassay tests will be conducted for each composite sample collected.

The following materials will be needed for collection of composite storm water runoff samples to be used in the chronic bioassays:

- o 10 liter plastic jugs
- o Ice chests (containing blue ice)

The composite samples will be chilled to $4^{o}C$ during collection and stored at this temperature until used. The samples will be used within 36 hours of collection.

4.4.2 Collection and Preparation of Composite Bay Water Samples

Collection of four composite bay water samples from the proposed bay water sampling points will require the same materials and preservation described in Section 4.4.1. The composite bay water samples will be manually collected over an 8-hour period (at the rate of 10 liters every hour) simultaneous to collection of storm water runoff samples. Prior to being used in the chronic bioassays, the bay water samples will be

diluted with deionized water to the same salinity as the storm water runoff samples. One suite of bioassay tests will be conducted for each composite sample collected.

4.4.3 Collection and Preparation of Reference Water Sample

Collection of a reference water sample from the proposed reference water sampling point, San Pablo Bay, will require the same materials and preservation described in Section 4.4.1. The reference water sample will be a 10 liter non-composited estuarine water sample collected from the surface at San Pablo Bay. Prior to being used in the chronic bioassays, the reference water will be diluted with deionized water to the same salinity as the storm water runoff samples.

4.4.4 Preparation of Dilution Water

For toxicity tests which are used to determine either the inherent toxicity of an effluent or the toxicity of an effluent in uncontaminated saline receiving water, it is recommended that dilution water be prepared from deionized water and artificial sea salts (EPA, 1988c). The dilution water will be prepared just prior to initiation of the bioassays from deionized water and either artificial sea salts or concentrated Bodega Bay water to the same salinity as the storm water samples. The dilution water will be used for the five dilution series described in Section 4.6.3 and as the control water in the suite of control bioassays.

4.5 LABORATORY SELECTION

The laboratory should be approved by the RWQCB as a bioassay laboratory, for chronic toxicity testing and should have participated in the EPA "Round-Robin" testing program with acceptable results.

4.6 LABORATORY PREPARATION OF BIOASSAY SYSTEMS

4.6.1 Materials

The following materials will be required for preparation of the bioassay systems:

- Thermometer
- Salinity meter
- Hypersaline brine (prepared from deionized water and artificial sea salts)
- Dissolved oxygen (DO) meter
- 30 um plankton net
- Bubble aeration apparatus
- pH Meter

4.6.2 Preparation

The following procedures will be employed for preparation of the bioassay systems:

- Tests will be conducted under conditions known to be non-stressful for the test organisms. The temperature and salinity of the test water will approximate the conditions where the organism was collected.

- o If necessary, the sample will be adjusted to appropriate salinity with hypersaline brine
- o DO of prefiltered sample will be measured and recorded
- o Sample water will be filtered with plankton net to remove indigenous organisms
- o DO of dilution water will be adjusted to near saturation
- o Sample and dilution water will be added to test tanks in the appropriate dilution ratios (See Section 4.6.3)
- o pH of test tanks will be measured and recorded

4.6.3 Dilution Series

A dilution factor of 0.3 will be used to allow testing between 100 percent and 1 percent of the storm water runoff and bay water samples using five concentrations (100%, 30%, 10%, 3%, 1%).

4.7 BIOASSAY PROCEDURES

4.7.1 Freshwater Bioassay Procedures

4.7.1.1 Fathead Minnow (*Pimephales promelas*) Survival and Growth Test - EPA Method 1000 (EPA, 1989)

This method will use fathead minnows, less than 36-hours old in a seven-day static renewal test of five storm water runoff dilutions (in geometric series). Synergistic, antagonistic, and additive effects of chemical, physical, and biological components will be considered by observing adverse effects or physiological and biochemical functions in the test species. Test results will be based on survival and growth (weight increase) of the larvae held in storm water test solutions compared with freshwater control sample larvae.

4.7.1.2 Cladoceran (*Ceriodaphnia dubia*) Survival and Reproduction Test - EPA Method 1002 (EPA, 1989)

This method will use cladocerans less than 24 hours old, and all within 8 hours of the same age in a seven-day static renewal test of five storm water run-off dilutions (in geometric series). Test results will be based on survival of the test organisms and reproduction and survival of offspring held in storm water test solutions compared with those held in freshwater control.

4.7.1.3 Algal (*Selenastrum capricornutum*) Growth Test - EPA Method 1003 (EPA, 1989)

This method will measure chronic toxicity of five dilutions of storm water runoff to freshwater algae during a four day (96 hour) static exposure. Synergistic, antagonistic, and additive effects of chemical, physical, and biological components will be considered by observing adverse effects of physiological and biochemical functions in the test species. The response of the algal population will be measured in terms of changes in cell density (cell counts per mL) biomass, chlorophyll content, or absorbance relative to freshwater control water samples.

4.7.2 Alternate Marine Bioassay Procedures

4.7.2.1 Inland Silverside (*Menidia beryllina*) Larval Survival and Growth Test - EPA Method 1006 (EPA, 1988c)

This method will use seven-to-eleven day old inland silverside larvae in a seven-day static renewal test of five

storm water runoff dilutions. Synergistic, antagonistic, and additive effects of chemical, physical, and biological components will be considered by observing adverse effects of physiological and biochemical functions in the test species. Test results will be based on survival and growth (weight increase) of test larvae as compared to bay water, reference, and control sample larvae. This test is recommended as a short term method for estimating chronic toxicity of effluents to estuarine and marine (5 - 32 parts per thousand) species.

4.7.2.2 Sand Dollar (*Dendraster excentricus*) or Sea Urchin (*Strongylocentrotus purpuratus*) Echinoderm Fertilization Success Test - Species Modified EPA Method 1008 (EPA, 1988c)

This rapid-chronic method will measure the toxicity of five storm water runoff dilutions to gametes of the sand dollar during a 1 hour and 20 minute exposure. By exposing dilute sperm suspensions to runoff dilutions for one hour, adding eggs and determining percent fertilization during a 20 minute period, the concentration of a test substance that reduces fertilization of exposed gametes relative to that of the bay water, reference, and control samples will be determined. The test species utilized will depend on the time period in which the bioassays are conducted. *D. excentricus* will be used if the test period falls in April through October; the sea urchin will be used during an October through April test period due to the different spawning periods of the organisms.

4.7.2.3 Algal (Skeletonema costatum) Growth Test - Species Modified EPA Method 1003 (EPA, 1985)

This method will measure the chronic toxicity of five dilutions of storm water runoff to marine algae during a four-day (96-hour), static exposure. Synergistic, antagonistic, and additive effects of chemical, physical, and biological components will be considered by observing adverse effects of physiological and biochemical functions in the test species. The response of the algal population will be measured in terms of changes in cell density (cell counts per mL), biomass, chlorophyll content, or absorbance relative to the bay water, reference, and control samples.

4.8 PRESENTATION OF DATA

Should survival of control groups be considered acceptable (greater than 90 percent), the results of the chronic bioassays will be presented in tabular form and discussed in the environmental evaluation section of the individual PHEEs. In the event that control mortality is unacceptably high, species selection and other test variables will be re-evaluated and the test repeated.

4.9 QUALITY ASSURANCE SUMMARY

Provisions for quality assurance will be made where applicable and specifically in the following areas:

- Storm water runoff samples will be collected from each runoff sampling point, preserved, and analyzed as proposed by the Proposed Reconnaissance Study of Storm Water Quality, Hunters Point Annex (HLA, 1988g)
- Test organisms will be disease-free and positively identified to species
- Laboratory and bioassay temperature control equipment will be adequate to maintain required test water temperature
- Instruments used for measurement of water parameters will be calibrated and standardized
- Survival of control groups will be at least 90 percent to be considered acceptable. The algal test will have cell density in controls after 96 hours greater than 10^6 cells/mL to be considered acceptable

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GLOSSARY

ANOVA	Analysis of variance
ATSM	American Society for Testing and Materials
ATT	Aqua Terra Technologies, Incorporated
CDFG	California Department of Fish and Game
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
DHS	California Department of Health Services
DO	Dissolved Oxygen
ECD	Electron Capture Detection
EIS	Environment Impact Statement
EPA	U.S. Environmental Protection Agency
EPA/COE	U.S. Environmental Protection Agency/Corps of Engineers
ESAP	Environmental Sampling and Analysis Plan
FDA	U.S. Food and Drug Administration
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrocopy
HLA	Harding Lawson Associates
HPA	Hunters Point Annex
IAS	Initial Assessment Study
ICP	Inductively Coupled Plasma Spectroscopy
IR	Installation Restoration
MSL	Mean Sea Level
NACIP	Navy Assessment and Control of Installation Pollutants
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration

NPDES	National Pollutant Discharge Elimination System
O&G	Oil and Grease
PA	Preliminary Assessment
PCBs	Polychlorinated biphenyls
PHEE	Public Health and Environmental Evaluation
QA/QC	Quality Assurance/Quality Control
RI/FS	Remedial Investigation/Feasibility Study
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SMW	State Mussel Watch
SOCs	Semi-volatile Organic Compounds
SWRCB	State Water Resources Control Board
VOCs	Volatile Organic Compounds

TABLES

Table 1. IR/PA Sites By Group*

Group	Site	Site Description	Known or Potential Site Contamination
Group I	IR-1	Industrial Landfill and Triple A Sites 1 and 16[a]	Liquid chemical wastes, asbestos, radium dials, and sand blast wastes with paint scrapings (1958-1974)
	IR-2	Bay Fill Area and Triple A Sites 2, 13, 14, 17, 18, and 19; excluding IR-3	Sand blast waste with heavy metals, chemicals, and waste oil (mid 1940s-1978)
	IR-3	Oil Reclamation Ponds and part of Triple A Site 17	Waste oil, solvents, caustic soda, chromates, and sand blast waste (1944-1974)
Group II	IR-6	Tank Farm	Diesel fuels and oils (1942-present)
	IR-8	Building 503 PCB Spill Area	PCBs
	IR-9	Pickling and Plate Yard	Zinc chromate and acids (1947-1973)
	IR-10	Battery and Electroplating Shop (Building 123)	Waste acids, heavy metals, cyanide wastes, and chromates (1946-1974)
Group III	IR-4	Scrap Yard and Triple A Site 3, north of Spear Avenue	Heavy metals and PCBs (1954-1974)
	IR-5	Old Transformer Storage Yard	PCBs (1946-1947)
Group IV	IR-7	Sub-base Area	Zinc chromate paint, diesel fuel, and sand blast waste
Group V	IR-11	Building 521 Power Plant	Asbestos (1950-1969)
	IR-12	Disposal Trench, Triple A Sites 3 (partial) and 4 (previously Site PA-12)	Metals, chemicals, and low levels of PCBs and asbestos (1976-1986)
	IR-13	Old Commissary Site, Triple A Sites 5 and 15 (previously Site PA-13)	Metals, low-levels of PCBs and chemicals, and unidentified hydrocarbons (1976-1986)
	IR-14	Oily Liquid Waste Disposal Site, Triple A Sites 6 and 7 (previously Site PA-14)	Chemicals, and possibly PCBs (1976-1986)

ESAP:9118.3:DFT/08/90/TBL-1

Table 1. IR/PA Sites by Group* (continued)

Group	Site	Site Description	Known or Potential Site Contamination
	IR-15	Oily Waste Ponds and Incineration Tank, Triple A Sites 12 and 13 (partial) (previously Site PA-15)	Metals, low-levels of chemicals, and possibly PCBs (1976-1986)
	IR-17	Drum Storage and Disposal Site, Triple A Sites 10 and 11 (previously Site PA-17)	Low-levels of PCBs (1976-1986)
NA[b]	PA-16	Container Storage Site, Triple A Site 9	PCBs and other substances based on reported history of Triple A disposal practices (1976-1986)
NA	PA-18	Waste Oil Disposal Site behind Dago Mary's, Unnumbered Triple A Site	Total petroleum hydrocarbons based on reported history of Triple A disposal practices and limited analytical data (1976-1986)

* Information for this table was taken from "The Navy's Environmental Cleanup of Hunters Point" Fact Sheet and the Site Inspection Work Plan, Sites PA-16 and PA-18, Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California (HLA, 1990b)

a This numbering system was previously used by the San Francisco District Attorney's Office and the U.S. Navy. These areas/sites have been included within IR and PA Sites

b NA: Not Applicable. Recommendations for inclusion of these sites in the Installation Restoration program will be based upon the results of the site inspections described in the work plan

Table 2. Summary of Underground Storage Tanks

Tank Number	Tank Contents	Status
S-001, S-002	Gasoline	BTX identified in soil gas vapors
S-003, S-004	Diesel	TCA, DCE, DCA, and TCE identified in vicinity of tanks
S-203 (212)	Gasoline	BTX identified in soil gas samples TCA, DCE, DCA, and TCE identified in vicinity of tank
S-209	Fuel Oil Water (if present)	Product on the groundwater surface PCE identified in tank contents
S-210 (213)	Water	PCB, toluene, ethylbenzene, and xylenes identified in tank contents No soil contamination by hydrocarbons identified
S-214	Fuel Oil Water	Soil contamination by hydrocarbons confirmed
S-215	Solvent	Xylenes identified in soil gas samples
S-251	Solvent	Xylenes identified in soil gas samples TCA, DCE, DCA, and TCE identified in vicinity of tank
S-304, S-305	Gasoline	BTX identified in soil gas samples TCA, DCE, DCA, and TCE identified in vicinity of tank
S-435(1), S-435(2)	Solvent with Gasoline	BTX identified in soil gas samples TCA, DCE, DCA, and TCE identified in vicinity of tank
S-508	Fuel Oil	Hydrocarbons and acetone identified in soil Acetone identified in tank contents
S-711, S-712 S-713	Gasoline	BTX identified in soil gas samples
S-714	Diesel	BTX identified in soil gas samples
S-715	Waste Oil and Water	Xylene and toluene identified in soil gas samples TCA, DCE, DCA, and TCE identified in vicinity of tank

ESAP:9118.3:DFT/08/90.TBL-2

Table 2. Summary of Underground Storage Tanks (continued)

Tank Number	Tank Contents	Status
S-801	Gasoline and Solvent	Petroleum hydrocarbons identified in soil
S-802	Gasoline	Petroleum hydrocarbons identified in soil
S-812	Fuel Oil	Soil contamination not indicated

BTX = Benzene, Toluene, Xylene
TCA = Trichloroethane
DCE = Dichloroethylene
DCA = Dichloroethane
TCE = Trichlorethylene
PCE = Tetrachloroethylene

Source: PRC, 1990

Table 3. Sampling and Analytical Program

Evaluation Program and Sample Location Numbers	Number of Samples[a]	Media Type[b]	Radio-Activity Screen	Toxicity Testing	Physical Testing[c]	Radio-Activity Testing	Inorganics/ Metals	Pesticides/ PCBs	Semi-Volatile Organics	Tributyltin	Volatile Organics
Sediment Toxicity											
S-1 to S-17	17	S	X	X[d]	X	X[e]	X[f]	X	X	X[g]	--
Reference	2	S	X	X	X	--	--	--	--	--	--
Control	1	S	X	X	X	--	--	--	--	--	--
Sediment Cores	19	S	X	--	--	X	Xf	X	X	X	--
Bioaccumulative Effect											
M-1 to M-17	17	T	X	--	--	X[e]	X[f]	X	X	X	--
Background	1	T	X	--	--	--	X[f]	X	X	X	--
Reference	3	T	X	--	--	--	X[f]	X	X	X	--
Storm Water Toxicity											
ST1 to ST4	4	SW	--	X[h]	--	--	X	X[i]	Xi	X[i]	X
B-1 to B-4	4	BW	--	X[h]	--	--	X	X[i]	X[i]	X[i]	X
Reference	1	BW	--	X[h]	--	--	--	--	--	--	--

a These numbers describe composited samples and do not include sub-samples removed for screening of radioactivity, toxicity testing, physical testing, chemical analyses, or Quality Control (QC) samples
b Media Type: S = sediment, T = tissue, SW = storm water, BW = bay water
c Physical testing includes determination of grain size
d Toxicity testing of sediment samples involves the use of five replicates in 10-day solid phase bioassays and liquid suspended particulate phase bioassays
e Laboratory testing of radioactivity will be conducted on samples exhibiting radioactivity above background levels as determined by radioactivity screening
f See Table 4 for specific inorganics/metals analysis
g Analytical method: n - Pentyl Derivitization with Gas Chromatography/Flame Photometric Detection
h Toxicity testing of storm and bay water samples involves a five dilution series
i Analysis of storm water samples will be conducted as described in the Proposed Reconnaissance Study of Storm Water Quality (HLA, 1988g)

Table 4. Analytical Methods for Inorganics/Metals

	Analytical Constituents	Analytical Method
CLP Inorganics	Aluminum	6010
	Antimony	6010
	Arsenic	7060
	Barium	6010
	Beryllium	6010
	Cadmium	6010
	Chromium (total)	6010
	Cobalt	6010
	Copper	6010
	Lead (total)	7421
	Mercury	7470
	Molybdenum	6010
	Nickel	6010
	Selenium	7740
	Silver	6010
	Thallium	7841
	Tin	6010
	Vanadium	6010
	Zinc	6010

Table 5. List of Selected Test Species

Task Number	Test Description	Type of Organism	Common Name	Scientific Name
1	Modified Solid-Phase Bioassay	Burrowing Infaunal Polychaete	Marine Worm	*Nephtys caecoides*
		Filter or Deposit-feeding Crustacean	Amphipod	*Eohaustorius estuarius*
		Deposit-feeding Crustacean	Mysid Shrimp	*Holmesimysis costata*
	Liquid Suspended Particulate-Phase Bioassay	Filter of Deposit feeding Bivalve	Oyster or Bay Mussel	*Crassostrea gigas* or *Mytilus edulis*
		Deposit-feeding Crustacean	Mysid Shrimp	*Holmesimysis costata*
		Fish	Sand Dab	*Citharichthys stigmaes*
2	Bioaccumulation	Bivalve	California Mussel	*Mytilus californianus*
3	Larval Survival and Growth	Fish	Fathead Minnow[a] or Inland Silverside[b]	*Pimephales promelas*[a] *or Menidia Beryllina*[b]
	Fertilization Success	Crustacean or Echinoderm	Water Flea[a] or Sand Dollar/Sea Urchin[b]	*Ceriodaphnia dubia*[a] or *Strongylocentrotus purpuratus* or *Dendraster excentricus*[b]
	Growth Test	Algae	Freshwater Algae[a] or Marine Algae[b]	*Selenastrum capricornutum*[a] or *Skeletonema castatum*[b]

a. Freshwater species to be used in bioassay if storm water in non-saline.
b. Marine species to be used in bioassay if storm water is saline.

ESAP:9118.3:DK#4/DFT/08/90/TBL-6

Table 6. CLP Analytical Methods for Sediment Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/Kg)
S-1 - S-17	Sediment	CLP Inorganics	Aluminum	10.0[a]
		(EPA Method 6010)	Antimony	3.0
		except for: 7060	Arsenic	0.5
			Barium	10.0
			Beryllium	0.25
			Cadmium	0.25
			Calcium	250.0
			Chromium (total)	0.5
			Cobalt	0.5
			Copper	0.5
			Iron	5.0
		7421	Lead (total)	0.15
			Magnesium	250.0
			Manganese	0.75
		7470	Mercury	0.01
			Molybdenum	0.50
			Nickel	2.0
			Potassium	250.0
		7740	Selenium	0.25
			Silver	0.5
			Sodium	250.0
		7841	Thallium	0.5
			Tin	0.25
			Vanadium	2.5
			Zinc	1.0
		CLP Pest/PCBs	alpha-BHC	8.0
		(EPA Method 8080)	beta-BHC	8.0
			gamma-BHC (Lindane)	8.0
			delta-BHC	8.0
			Heptachlor	8.0
			Aldrin	8.0
			Heptachlor epoxide	8.0

Table 6. CLP Analytical Methods for Sediment Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/Kg)
		CLP Pest/PCBs (EPA Method 8080) (continued)	Endosulfan I	8.0
			p,p'-DDE	16.0
			Dieldrin	16.0
			Endrin	16.0
			p,p'-DDD	16.0
			Endosulfan II	16.0
			p,p'-DDT	16.0
			Endrin aldehyde	16.0
			Endosulfan sulfate	16.0
			p,p'-Methoxychlor	80.0
			Endrin ketone	16.0
			Technical chlordane	80.0
			Toxaphene	160.0
			Aroclor 1016	80.0
			Aroclor 1221	80.0
			Aroclor 1232	80.0
			Aroclor 1242	80.0
			Aroclor 1248	80.0
			Aroclor 1254	160.0
			Aroclor 1260	160.0
		CLP SOCs (EPA Method 8270)	Phenol	330
			bis(2-Chloroethyl) Ether	330
			2-Chlorophenol	330
			1,3-Dichlorobenzene	330
			1,4-Dichlorobenzene	330
			Benzyl Alcohol	330
			1,2-Dichlorobenzene	330
			2-Methylphenol	330
			bis(2-Chloroisopropyl) Ether	330
			4-Methylphenol	330

Table 6. CLP Analytical Methods for Sediment Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/Kg)
		CLP SOCs EPA Method 8270 (continued)	N-Nitroso-di-n-Propylamine	330
			Hexachloroethane	330
			Nitrobenzene	330
			Isophorone	330
			2-Nitrophenol	330
			2,4-Dimethylphenol	330
			Benzoic Acid	1600
			bis(2-Chloroethoxy)Methane	330
			2,4-Dichlorophenol	330
			1,2,4-Trichlorobenzene	330
			Naphthalene	330
			4-Chloroaniline	330
			Hexachlorobutadiene	330
			4-Chloro-3-Methylphenol	330
			2-Methylnaphthalene	330
			Hexachlorocyclopentadiene	330
			2,4,6-Trichlorophenol	330
			2,4,5-Trichlorophenol	1600
			2-Chloronaphthalene	330
			2-Nitroaniline	1600
			Dimethylphthalate	330
			Acenaphthylene	330
			3-Nitroaniline	1600
			Acenaphthene	330
			2,4-Dinitrophenol	1600
			4-Nitrophenol	1600
			Dibenzofuran	330
			2,4-Dinitrotoluene	330
			2,6-Dinitrotoluene	330
			Diethylphthalate	330
			4-Chlorophenyl-Phenyl Ether	330

Table 6. CLP Analytical Methods for Sediment Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/Kg)
		CLP SOCs	Fluorene	330
		EPA Method 8270	4-Nitroaniline	1600
		(continued)	4,6-Dinitro-2-Methylphenol	330
			N-Nitrosodiphenylamine	330
			Azobenzene	330
			4-Bromophenyl-Phenyl Ether	330
			Hexachlorobenzene	330
			Pentachlorophenol	1600
			Phenanthrene	330
			Anthracene	330
			Di-n-Butylphthalate	330
			Fluoranthene	330
			Benzidine	1600
			Pyrene	330
			Butylbenzylphthalate	330
			3,3'-Dichlorobenzidine	660
			Benzo(a)Anthracene	330
			bis(2-Ethylhexl)phthalate	330
			Chrysene	330
			Di-n-Octylphthalate	330
			Benzo(b)Fluoranthene	330
			Benzo(k)Fluoranthene	330
			Benzo(a)Pyrene	330
			Indeno(1,2,3-cd)Pyrene	330
			Dibenz(a,h)Anthracene	330
			Benzo(g,h,i)Perylene	330
		GC/FPD[b] with n-pentyl-derivization	Tributyltin	10

a. Quantitation limit values for inorganics are given in mg/Kg.
b. Gas chromatography/flame photometric detection

Table 7. CLP Analytical Methods for Mussel Tissue Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Reporting Limit (µg/Kg)
M-1 - M-17	Mussel Tissue	6010/ICP[a]	Aluminum	200
			Antimony	60
		7060/AA[b]	Arsenic	NA
			Barium	100
			Beryllium	10
			Cadmium	10
			Calcium	1000
			Chromium (total)	10
			Cobalt	50
			Copper	25
			Iron	100
		7421/AA[b]	Lead (total)	40
			Magnesium	1000
			Manganese	15
			Molybdenum	10
			Nickel	40
			Potassium	1000
		7740/AA[b]	Selenium	NA
			Silver	10
			Sodium	1000
		7841/AA[b]	Thallium	80
			Tin	40
			Vanadium	50
			Zinc	20
		7471/Cold Vapor AA[b]	Mercury	10
		8080/GC/MS[c]	alpha-BHC	NA
			beta-BHC	NA
			gamma-BHC (Lindane)	NA
			delta-BHC	NA
			Heptachlor	NA

Table 7. CLP Analytical Methods for Mussel Tissue Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Reporting Limit (µg/Kg)
		8080/GC/MS[c] (continued)	Aldrin	NA
			Heptachlor epoxide	NA
			Endosulfan I	10.0
			p,p'-DDE	NA
			Dieldrin	2.0
			Endrin	2.0
			p,p'-DDD	NA
			Endosulfan II	2.0
			p,p'-DDT	NA
			Endrin aldehyde	NA
			Endosulfan sulfate	25.0
			p,p'-Methoxychlor	NA
			Endrin ketone	NA
			Technical chlordane	25.0
			Toxaphene	30.0
			Aroclor 1016	20.0
			Aroclor 1221	20.0
			Aroclor 1232	20.0
			Aroclor 1242	20.0
			Aroclor 1248	20.0
			Aroclor 1254	20.0
			Aroclor 1260	20.0
		8270/GC/MS[c]	Phenol	160.0
			bis(2-Chloroethyl) Ether	160.0
			2-Chlorophenol	160.0
			1,3-Dichlorobenzene	160.0
			1,4-Dichlorobenzene	160.0
			Benzyl Alcohol	160.0
			1,2-Dichlorobenzene	160.0
			2-Methylphenol	160.0
			bis(2-Chloroisopropyl) Ether	160.0
			4-Methylphenol	160.0

Table 7. CLP Analytical Methods for Mussel Tissue Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Reporting Limit (µg/Kg)
		8270/GC/MS[c] (continued)	N-Nitroso-di-n-Propylamine	160.0
			Hexachloroethane	160.0
			Nitrobenzene	160.0
			Isophorone	160.0
			2-Nitrophenol	160.0
			2,4-Dimethylphenol	160.0
			Benzoic Acid	800.0
			bis(2-Chloroethoxy)Methane	160.0
			2,4-Dichlorophenol	160.0
			1,2,4-Trichlorobenzene	160.0
			Naphthalene	160.0
			4-Chloroaniline	160.0
			Hexachlorobutadiene	160.0
			4-Chloro-3-Methylphenol	160.0
			2-Methylnaphthalene	160.0
			Hexachlorocyclopentadiene	160.0
			2,4,6-Trichlorophenol	160.0
			2,4,5-Trichlorophenol	800.0
			2-Chloronaphthalene	160.0
			2-Nitroaniline	800.0
			Dimethylphthalate	160.0
			Acenaphthylene	160.0
			3-Nitroaniline	800.0
			Acenaphthene	160.0
			2,4-Dinitrophenol	800.0
			4-Nitrophenol	800.0
			Dibenzofuran	160.0
			2,4-Dinitrotoluene	160.0
			2,6-Dinitrotoluene	160.0
			Diethylphthalate	160.0
			4-Chlorophenyl-Phenyl Ether	160.0
			Fluorene	160.0
			4-Nitroaniline	800.0

Table 7. CLP Analytical Methods for Mussel Tissue Analyses (continued)

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Reporting Limit (µg/Kg)
		8270/GC/MS[c] (continued)	4,6-Dinitro-2-Methylphenol	800.0
			N-Nitrosodiphenylamine	160.0
			Azobenzene	160.0
			4-Bromophenyl-Phenyl Ether	160.0
			Hexachlorobenzene	160.0
			Pentachlorophenol	800.0
			Phenanthrene	160.0
			Anthracene	160.0
			Di-n-Butylphthalate	160.0
			Fluoranthene	160.0
			Benzidine	800.0
			Pyrene	160.0
			Butylbenzylphthalate	160.0
			3,3'-Dichlorobenzidine	320.0
			Benzo(a)Anthracene	160.0
			bis(2-Ethylhexl)phthalate	160.0
			Chrysene	160.0
			Di-n-Octylphthalate	160.0
			Benzo(b)Fluoranthene	160.0
			Benzo(k)Fluoranthene	160.0
			Benzo(a)Pyrene	160.0
			Indeno(1,2,3-cd)Pyrene	160.0
			Dibenz(a,h)Anthracene	160.0
			Benzo(g,h,i)Perylene	160.0
		GC/FPD[b] with n-pentyl-derivization	Tributyltin	100

a. ICP; Inductively Coupled Plasma Spectroscopy
b. AA; Atomic Absorption
c. GC/MS; Gas Chromatography/Mass Spectoscopy
d. GC/FPD; Gas Chromatography/Flame Photometric Detection
NA - Not available

Table 8. CLP[a] Analytical Methods for Storm Water Runoff Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/L)
ST-1 - ST-4 B-1 - B-4	Water	CLP Inorganics	Aluminum	200.0
		(EPA Method 200.7)	Antimony	3.0
		except for: 206.2	Arsenic	10
			Barium	100.0
			Beryllium	5.0
			Cadmium	5.0
			Calcium	1000
			Chromium (total)	10.0
			Cobalt	50.0
			Copper	25
			Iron	100
		239.2	Lead (total)	3.0
			Magnesium	1000
			Manganese	15.0
		245.1	Mercury	0.5
			Molybdenum	10.0
			Nickel	40.0
			Potassium	1000
		270.2	Selenium	5.0
			Silver	10.0
			Sodium	1000
		279.2	Thallium	10.0
			Tin	40.0
			Vanadium	50.0
			Zinc	20.0
		CLP Pest/PCBs	alpha-BHC	0.05
		(EPA Method 608)	beta-BHC	0.05
			gamma-BHC (Lindane)	0.05
			delta-BHC	0.05
			Heptachlor	0.05
			Aldrin	0.05

Table 8. CLP Analytical Methods for Storm Water Runoff Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/L)
			Heptachlor epoxide	0.05
			Endosulfan I	0.1
			p,p'-DDE	0.1
			Dieldrin	0.1
			Endrin	0.1
			p,p'-DDD	0.1
			Endosulfan II	0.1
			p,p'-DDT	0.1
			Endrin aldehyde	0.1
			Endosulfan sulfate	0.1
			p,p'-Methoxychlor	0.5
			Endrin ketone	0.1
			Technical chlordane	0.5
			Toxaphene	1.0
			Aroclor 1016	0.5
			Aroclor 1221	0.5
			Aroclor 1232	0.5
			Aroclor 1242	0.5
			Aroclor 1248	0.5
			Aroclor 1254	1.0
			Aroclor 1260	1.0
		CLP SOCs	Phenol	10
		(EPA Method 625)	bis(2-Chloroethyl) Ether	10
			2-Chlorophenol	10
			1,3-Dichlorobenzene	10
			1,4-Dichlorobenzene	10
			Benzyl Alcohol	10
			1,2-Dichlorobenzene	10
			2-Methylphenol	10
			bis(2-Chloroisopropyl) Ether	10
			4-Methylphenol	10

Table 8. CLP Analytical Methods for Storm Water Runoff Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/L)
			N-Nitroso-di-n-Propylamine	10
			Hexachloroethane	10
			Nitrobenzene	10
			Isophorone	10
			2-Nitrophenol	10
			2,4-Dimethylphenol	10
			Benzoic Acid	50
			bis(2-Chloroethoxy)Methane	10
			2,4-Dichlorophenol	10
			1,2,4-Trichlorobenzene	10
			Naphthalene	10
			4-Chloroaniline	10
			Hexachlorobutadiene	10
			4-Chloro-3-Methylphenol	10
			2-Methylnaphthalene	10
			Hexachlorocyclopentadiene	10
			2,4,6-Trichlorophenol	10
			2,4,5-Trichlorophenol	50
			2-Chloronaphthalene	10
			2-Nitroaniline	50
			Dimethylphthalate	10
			Acenaphthylene	10
			3-Nitroaniline	50
			Acenaphthene	10
			2,4-Dinitrophenol	50
			4-Nitrophenol	50
			Dibenzofuran	10
			2,4-Dinitrotoluene	10
			2,6-Dinitrotoluene	10
			Diethylphthalate	10
			4-Chlorophenyl-Phenyl Ether	10
			Fluorene	10

Table 8. CLP Analytical Methods for Storm Water Runoff Analyses

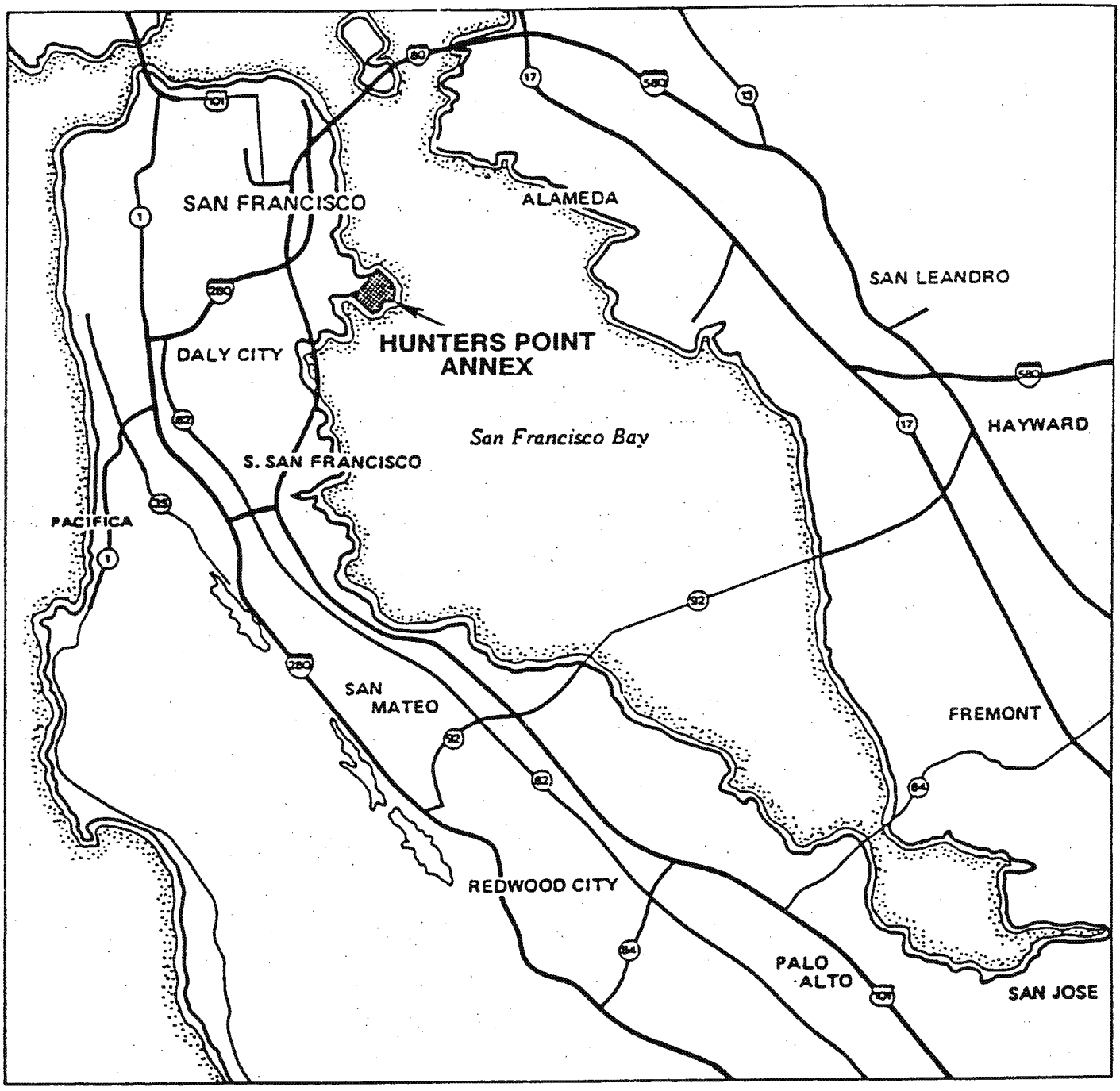
Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/L)
			4-Nitroaniline	50
			4,6-Dinitro-2-Methylphenol	10
			N-Nitrosodiphenylamine	10
			Azobenzene	10
			4-Bromophenyl-Phenyl Ether	10
			Hexachlorobenzene	10
			Pentachlorophenol	50
			Phenanthrene	10
			Anthracene	10
			Di-n-Butylphthalate	10
			Fluoranthene	10
			Benzidine	50
			Pyrene	10
			Butylbenzylphthalate	10
			3,3'-Dichlorobenzidine	20
			Benzo(a)Anthracene	10
			bis(2-Ethylhexl)phthalate	10
			Chrysene	10
			Di-n-Octylphthalate	10
			Benzo(b)Fluoranthene	10
			Benzo(k)Fluoranthene	10
			Benzo(a)Pyrene	10
			Indeno(1,2,3-cd)Pyrene	10
			Dibenz(a,h)Anthracene	10
			Benzo(g,h,i)Perylene	10
		GC/FPD[c] with n-pentyl-derivitization	Tributyltin	10

Table 8. CLP Analytical Methods for Storm Water Runoff Analyses

Sample Numbers	Sample Matrix	Analytical Method	Analytical Constituents	Approximate Quantitation Limits (µg/L)
T1-ST4	Water	CLP VOCs (EPA Method 624)	Chloromethane	10
			Vinyl Chloride	10
			Bromomethane	10
			Chloroethane	10
			Trichlorofluoromethane	5
			1,1-Dichloroethene	5
			Trichlorotrifluoroethane	5
			Acetone	20
			Carbondisulfide	5
			Methylene Chloride	5
			trans-1,2-Dichloroethene	5
			1,1-Dichloroethane	5
			2-Butanone	20
			cis-1,2-Dichloroethene	5
			Chloroform	5
			1,1,1-Trichloroethane	5
			Carbon Tetrachloride	5
			Benzene	5
			1,2-Dichloroethane	5
			Trichloroethene	5
			1,2-Dichloropropane	5
			Bromodichloromethane	5
			2-Chloroethylvinyl Ether	5
			Vinyl Acetate	10
			trans-1,3-Dichloropropene	5
			4-Methyl-2-Pentanone	10
			Tolueene	5
			cis-1,3-Dichloropropene	5
			1,1,2-Trichloroethane	5
			Tetrachloroethene	5
			2-Hexanone	10
			Dibromochloromethane	5
			Chlorobenzene	5
			Ethylbenzene	5
			Total Xylenes	5
			Styrene	5
			Bromoform	5
			1,1,2,2-Tetrachloroethane	5
			1,3-Dichlorobenzene	5
			1,4-Dichlorobenzene	5
			1,2-Dichlorobenzene	5

a. CLP; Contract Laboratory Program
b. Quantitation limit values for inorganics are given in mg/Kg.
c. Gas chromatography/flame photometric detection

PLATES



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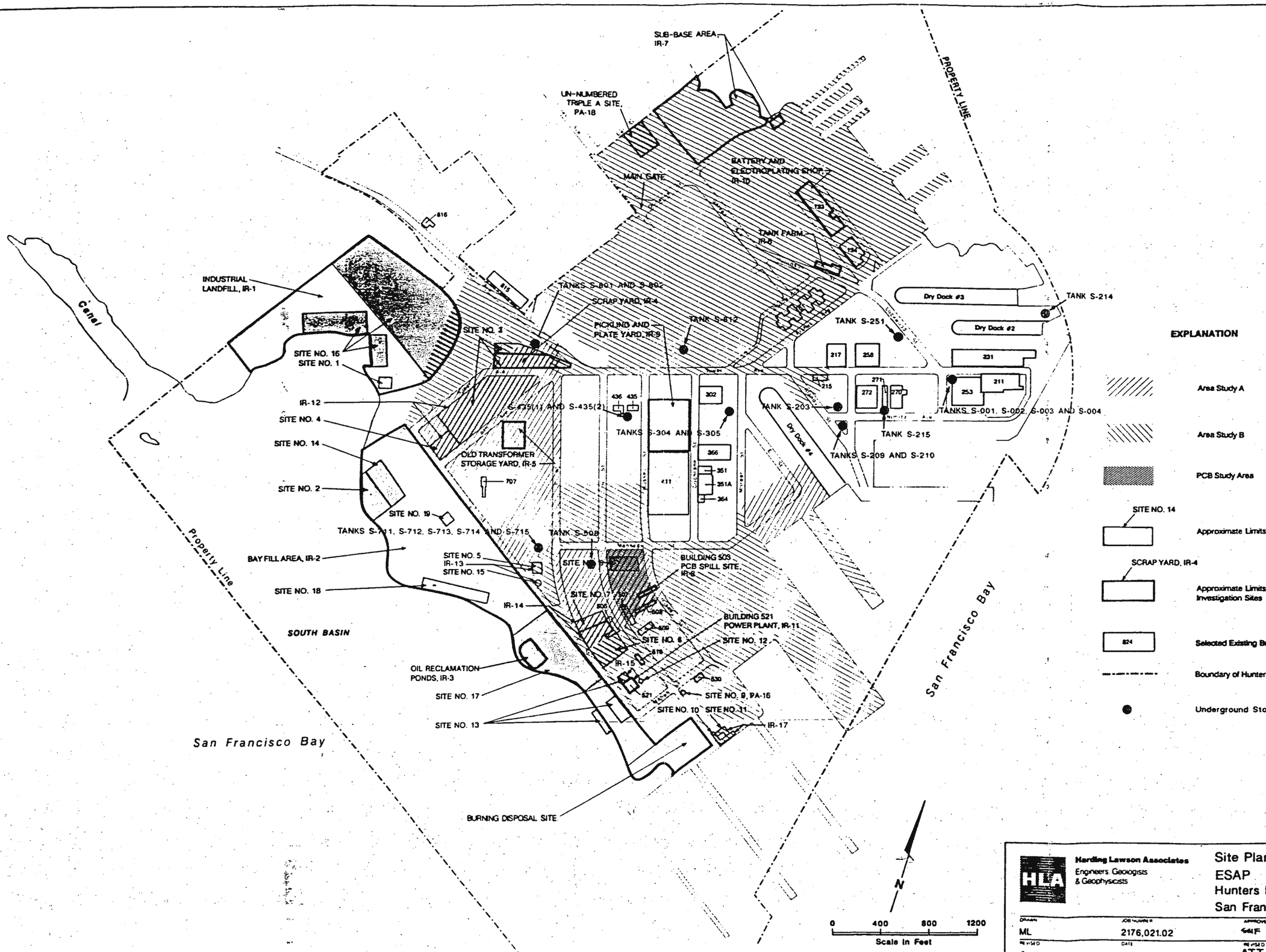
Engineers, Geologists
& Geophysicists

Location Map
ESAP
Hunters Point Annex
San Francisco, California

PLATE
1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
DM	2176,121.02	SMF	11/87	ATT	8/90



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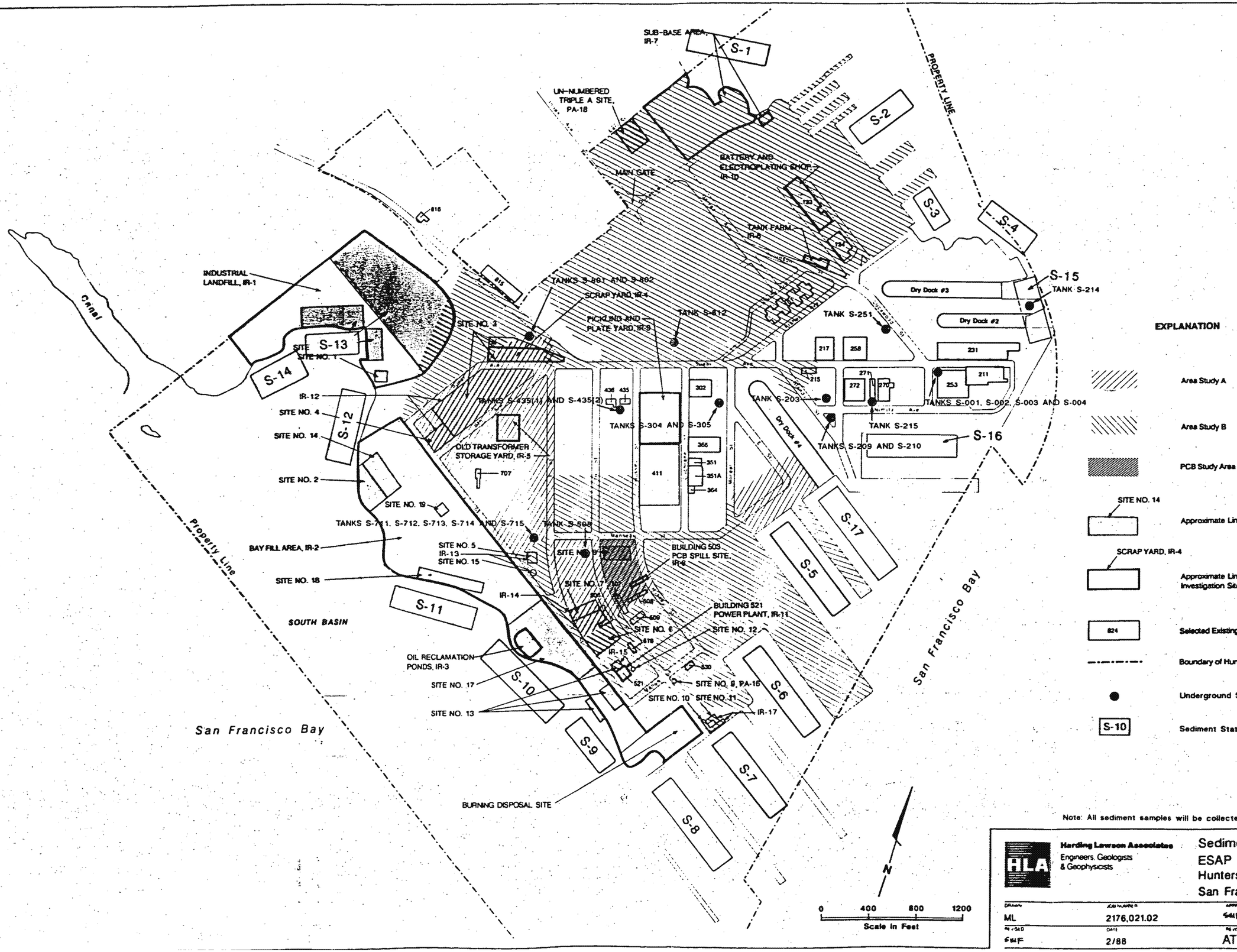
Site Plan
ESAP
Hunters Point Annex
San Francisco, California

PLATE 2

DRAWN	JOB NUMBER	APPROVED	DATE
ML	2176,021.02	GMF	11/87
REVISED	DATE	REVISED	DATE
GMF	2/88	ATT	8/90

2906



Note: All sediment samples will be collected from within HPA property boundaries.

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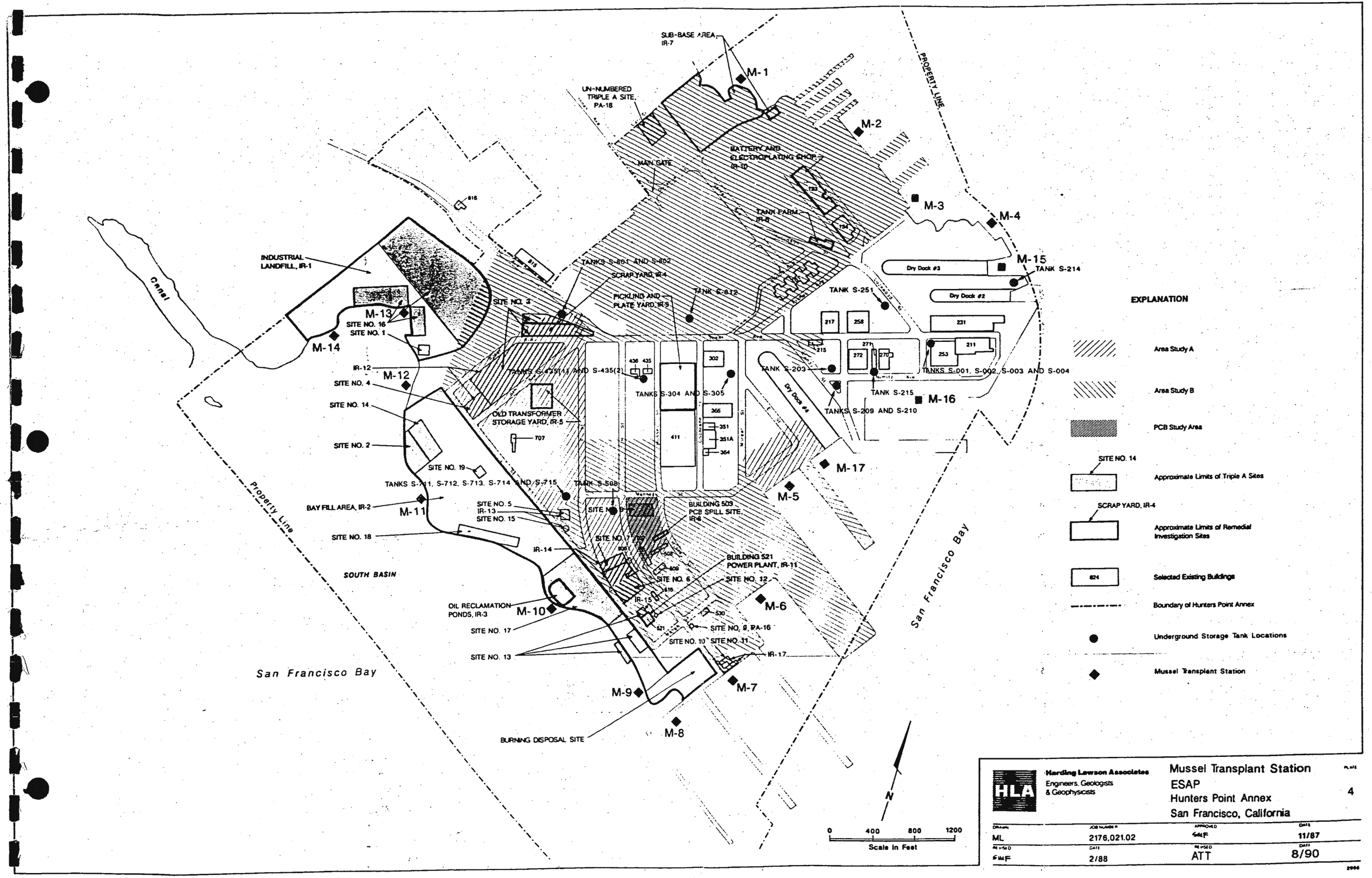
Sediment Station Areas
ESAP
Hunters Point Annex
San Francisco, California

PLATE 3

DRAWN	JOB NUMBER	APPROVED	DATE
ML	2176,021.02	SMF	11/87
REVISED	DATE	REVISED	DATE
SMF	2/88	ATT	8/90



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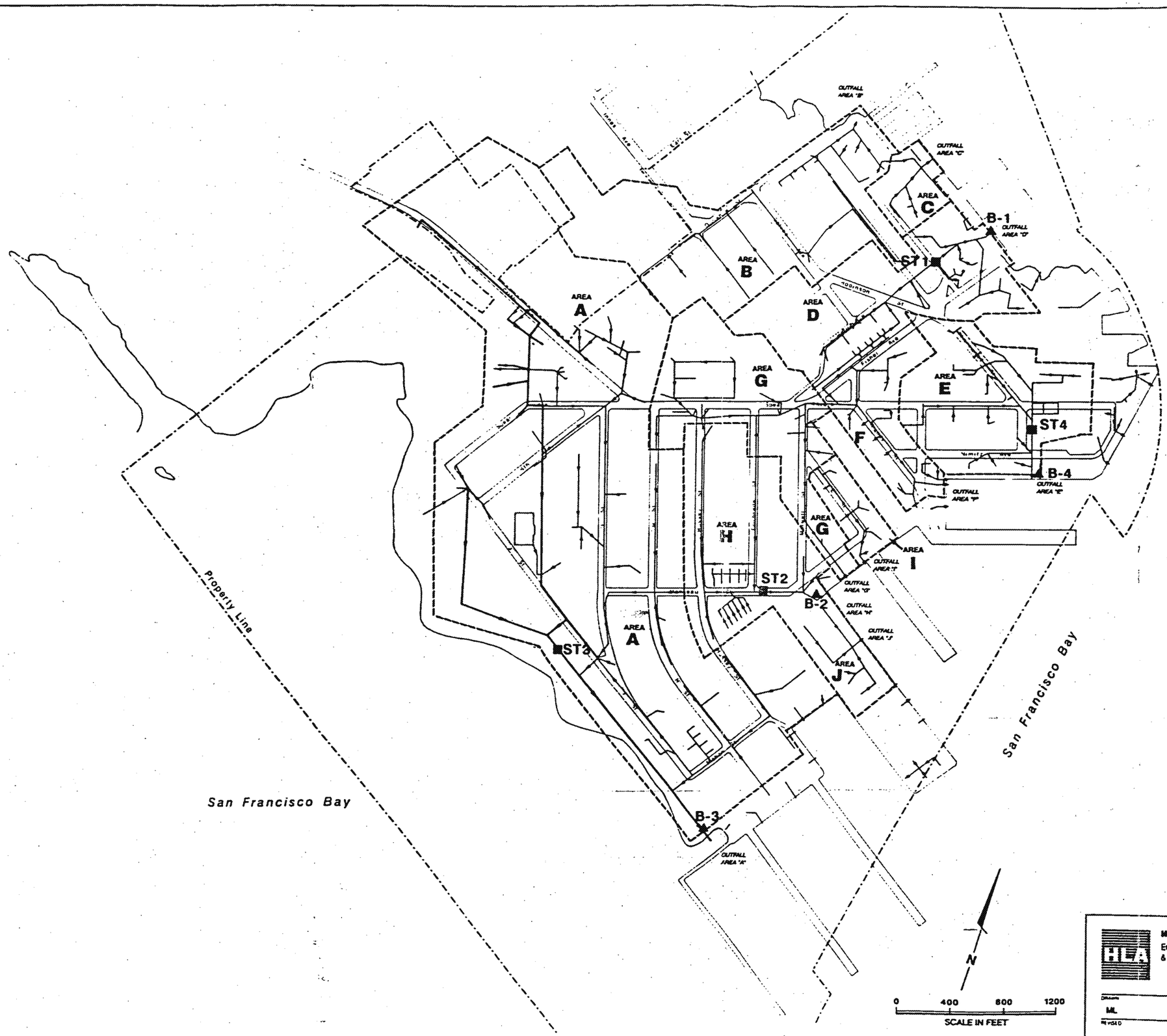
Mussel Transplant Station
ESAP
Hunters Point Annex
San Francisco, California

PLATE 4

DRAWN	JOB NUMBER	APPROVED	DATE
ML	2176,021.02	SMF	11/87
REVISED	DATE	REVISED	DATE
SMF	2/88	ATT	8/90

2906

Lily Outfall
Area D, Not B
Add B for BCE
Study



EXPLANATION

- Existing Pipe
- New Pipe
- Boundaries for Drainage Area
- Storm Water Sampling Point
- Bay Water Sampling Point

Harding Lawson Associates
Engineers, Geologists & Geophysicists

Water Sampling Points
ESAP
Hunters Point Annex
San Francisco, California

PLATE 5

DRAWN	JOB NUMBER	APPROVED	DATE
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REVISED	DATE	REVISED	DATE
	12/89	ATT	8/90

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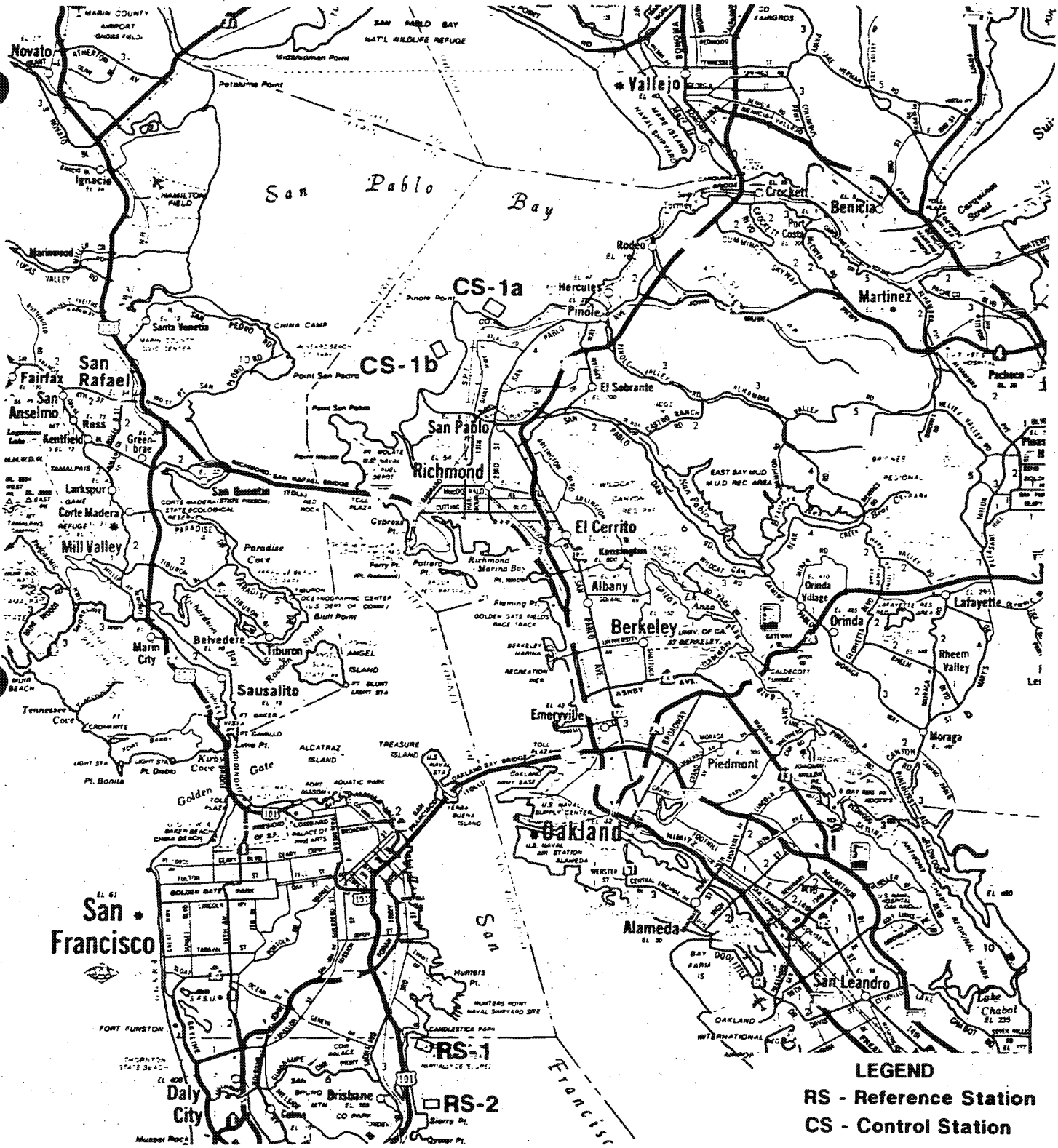


Sediment Control and Reference Station Areas

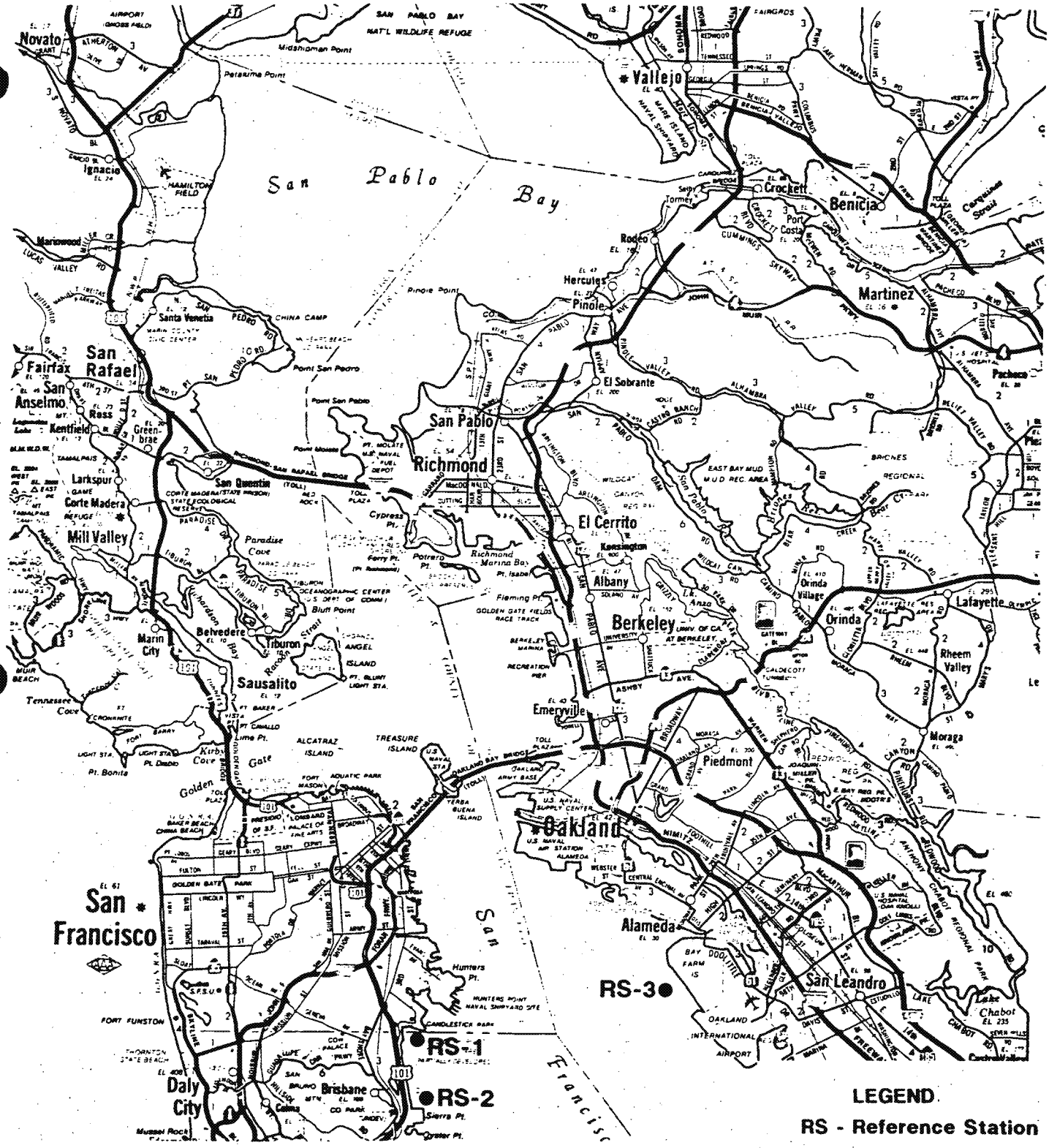
HLA-Hunters Point Annex, ESAP

PLATE 6

JOB NUMBER 9118.3

DATE 3/91

ATT Aqua Terra Technologies Consulting Engineers & Scientists



Mussel Transplant Reference Stations

ATT Aqua Terra Technologies
Consulting Engineers
& Scientists

HLA-Hunters Point Annex, ESAP

JOB NUMBER	DATE	PLATE
9118.3	3/91	7

APPENDICES

APPENDIX A

Regulatory Agency Comments on ESAP Responses to Comments

DHS Comments on the Draft Environmental Sampling and Analysis Plan (ESAP) for Hunters Point Annex - 28 August 1990

#	Pg.	Sec.	Pgph	Comment
1	1-5	1.4.2	4	Do you propose using the EMCON chemical and bioassay data in conjunction with the data generated by the ESAP? Were the protocols and analysis used by EMCON the same as proposed in the ESAP? Why is this area not addressed in this ESAP?
2	2-2	2.2.1	2	The Department recommends that sediment sampling stations be established for the dry dock 4 area; in the docking area east of dry dock 4 (adjacent to buildings 270-272); and north of the submarine dry dock areas.
3	2-2	2.2.1	2	The location of S-11 and/or S-12 may need to be relocated pending identification of a firing range identified along the landfill shoreline.
5	2-3	2.2.2	2	Provide a map identifying the specific location of the reference site in the San Pablo Bay.
6	2-6	2.4	3	Add a sentence identifying that samples collected for tributyltin analysis will be frozen within 24 hours (as identified in Section 2.9).
7	2-6	2.5	3	Why are surface water samples being collected instead of water near the bottom of the sediments?
8	2-9	2.7	1	Discuss what will be done if bioassay control mortality is greater than 10%.
9	3-2	3.2	2	The Department recommends that mussel station sampling areas be established for the dry dock 4 area; in the docking area east of dry dock 4 (adjacent to buildings 270-272); and North of the submarine dry dock areas.
10	3-8	3.9.1	2	Specify the difference in analytical procedures for metal analysis and identify why the change was made.
11	Table 3.			For Note "g", define "significant results" as greater than 50% sediment bioassay mortality or reference Section 2.9.

RESPONSE TO DHS COMMENTS ON DRAFT ESAP

DHS Comments on the Draft Environmental Sampling and Analysis Plan (ESAP)
for Hunters Point Annex - 28 August 1990.
Response to DHS Comments

Comment #1: Page 1-5, Section, 1.4.2, Paragraph 4

Do you propose using the EMCON chemical and bioassay data in conjunction with the data generated by the ESAP? Were the protocols and analysis used by EMCON the same as proposed in the ESAP? Why is this area not addressed in this ESAP?

Response: **As agreed upon in the Technical Review Committee (TRC) meeting on January 10, 1991, and as required by the U.S. Environmental Protection Agency, the protocol followed in the ESAP sediment toxicity evaluation will follow the EPA/COE "Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters", January, 1990 Guidelines. The protocol and anlysis used in the ESAP differs somewhat from the EMCON study. The EMCON data may not be directly comparable to the ESAP data, due to these differences. Where the protocol and analysis for the EMCON study and the ESAP are similar enough to draw valid conclusions from data comparisons, the ESAP data will be reviewed in conjunction with EMCON data.**

Comment #2: Page 2-2, Section, 2.2.1, Paragraph 2

The Department recommends that sediment sampling stations be established for the dry dock 4 area; in the docking area east of dry dock 4 (adjacent to buildings 270-272); and north of the submarine dry dock areas.

Response: **Three sediment sampling stations have been established for the dry dock areas, as discussed in the January 10, 1991 TRC meeting.**

Comment #3: Page 2-2, Section, 2.2.1, Paragraph 2

The location of S-11 and/or S-12 may need to be relocated pending identification of a firing range identified along the landfill shoreline.

Response: **The location of the noted firing range has been identified by the U.S. Navy and the location of sample station S-11 has been adjusted to encompass an area potentially impacted by substances (i.e. lead) from the firing range.**

Comment #5: Page 2-3, Section, 2.2.2, Paragraph 2

Provide a map identifying the specific location of the reference site in the San Pablo Bay.

Responses: **The ESAP has been revised to include reference and control sediment stations. The San Pablo Bay will be used as the control station area. The specific location of the control site in San Pablo Bay will be determined based on preliminary sediment sampling to determine compatibility of the sediment grain size in the proposed control site in San Pablo Bay with grain sizes at HPA. Areas from which potential control station samples will be collected is shown on Plate 6 in the ESAP. Reference stations in San Francisco Bay have been added to the ESAP and are shown on Plate 6 also.**

Comment #6: Page 2-6, Section 2.4, Paragraph 3

Add a sentence identifying that samples collected for tributyltin analysis will be frozen within 24-hours (as identified in Section 2.9)

Response: **A sentence has been added identifying that samples collected for tributyltin analysis will be frozen within 24-hours as requested.**

Comment #7: Page 2-6, Section 2.5, Paragraph 3

Why are surface water samples being collected instead of water near the bottom of the sediments?

Response: **In accordance with the agency agreement reached at TRC meeting on January 10, 1991, prepared seawater will be used for the bioassay systems rather than water collected from San Pablo Bay.**

Comment #8: Page 2-9, Section 2.7, Paragraph 1

Discuss what will be done if bioassay control mortality is greater than 10%.

Response: **The 1990 Greenbook states that "unacceptably high control mortality indicates that the organisms are being affected by important stresses other than contamination in the materials being tested (i.e. injury, disease, unfavorable chemical or physical conditions in test containers, improper handling or acclimation, or unsuitable grain size)". In this event, species selection or other variables will be reevaluated in an attempt to reduce unacceptably high mortality and the test repeated. In addition, statistical analysis of the data will allow for the possibility of accepting control mortality greater than 10%. This analysis will be used to evaluate whether test mortality was greater than control mortality regardless of the observed control mortality.**

Comment #9: Page 3-2, Section 3.2, Paragraph 2

The Department recommends that mussel station sampling areas be established for the dry dock 4 area; in the docking area east of dry dock 4 (adjacent to buildings 270-272); and North of the submarine dry dock areas.

Response: **Three mussel station sampling areas have been established in the vicinity of the dry dock areas, as agreed upon at the January 10, 1991 TRC meeting.**

Comment #10: Page 3-8, Section 3.9.1, Paragraph 2

Specify the difference in analytical procedures for metal analysis and identify why the change was made.

Response: **The State Mussel Watch Program (SMWP) utilizes either flame atomic absorption (AA) or graphite furnace AA methodology (EPA Method 7000 series) for metal analysis with the exception of mercury which is analyzed by cold vapor AA (EPA Method 7471).**

The ESAP proposes to use the inductively coupled argon plasma (ICP) instrumentation (EPA Method 6010) for inorganic/metal analysis with the exception of selenium, arsenic, lead, and

thallium which will be analyzed by graphite furnace AA (EPA Method 7000 series) and mercury which will be analyzed by cold vapor AA.

The proposed analytical program in the ESAP contains 5 more metal analytes than the SMWP, therefore, the ICP was considered as a more appropriate methodology. The metals to be analyzed by AA methodologies in the ESAP, cannot all be analyzed by ICP methods. Both AA and ICP methods are accepted by EPA and the detection limits for flame AA and ICP methods are identical for metals.

Comment #11: Table 3.

For Note "g", define "significant results" as greater than 50% sediment bioassay mortality or reference Section 2.9.

Response: **This note has been deleted from Table 3 because all of the sediment samples will be laboratory analyzed.**

State of California The Resources Agency

Memorandum

To : Mark Malinowski
Department of Health Services

Date : November 15, 1990

From : Department of Fish and Game

Subject: U.S. Navy, Treasure Island, Hunters Point Annex, San Francisco - Comments and Recommendations on Environmental Sampling and Analysis Plan (Aug,1990).

It is my understanding that the objectives of the draft program are to provide sufficient data to address potential environmental effects associated with the release of contaminants from the subject facility. Page 1-1 of the draft plan explains that this study will supplement previous environmental sampling programs, yet is somewhat vague in its discussion of the specific uses for which the data may be sufficient for decision-making opportunities.

One of the major shortcomings of this effort is its focus away from any current activity which may be subject to an existing regulatory program, ie. dredging, or evaluation of current site operations at dry dock #4. Another shortcoming is its broad brush approach to risk analysis, based not on the health, or relative contaminant burdens of the local biota, but rather on short-term exposure of transplanted or laboratory animals to composite samples of water and sediments collected from many general areas of the facility and periphery. I question if the data will be "sufficient to address specific environmental concerns..." mentioned on the first page. I offer the following specific comments for your consideration.

p.2-1 The question of sediment toxicity must not be restricted to just near surface deposits. The sediment column deposited since 1869 should be analyzed. While it may be concluded later that remediation of deeper sediments is unnecessary or impractical, the assessment shouldn't be so severely restricted.

Chemical analysis of sediments should be undertaken on all samples, not just those exhibiting greater than 50% mortality in the bioassay. If any "indicator of concern" is applied as a criterion for chemical analysis, "any significant mortality" (greater than that experienced in a valid reference test) would be more appropriate.

p. 2-2 The exclusion from consideration in test station selection of "Areas of little or no influence from present uses at HPA"or "Areas of little or no influence from potential sources of contamination other than HPA" are unwarranted as they eliminate proper evaluation of historical problems within those areas on the basis of reducing cause and effect conflicts. There may be good reasons for excluding certain areas, but these do not seem appropriate.

p. 2-5 Sediment sampling areas, proposed on Plate 3, appear to be appropriately distributed, but seem excessively large. Compositing 10 subsamples

collected within the sample area will likely obscure identification of hot spots and make data interpretation more difficult. I suggest that no more than 3 discrete samples be collected within the proposed sample sites. If greater volume of sediment is needed for chemical and biological tests, more grabs or cores should be taken and perhaps composited. Individual samples as well as composites should be handled and/or composited in a manner which maintains stratographic integrity. Sediments should be analyzed in at least 3 distinct regions, ie., upper 4-5 inches, 5in to 2ft, and 2-10ft. Additional subsamples should be taken and analyzed if obvious sandblast debris or other changes in sediment characteristics are observed. Bulk sediment analyses are essential for evaluation and interpretation of biological data. Solid phase bioassays could be restricted, if this is a Phase I project, to the surficial sediments, as long as chemical analyses are undertaken on deeper sediments as well as those tested for toxicity.

Sediment compositing and preparation methods should be revised to reflect discrete sampling methods. Screening for benthic invertebrates, discussed as a preliminary step in sample preparation, should be undertaken as soon as possible after collection. This provides an opportunity to identify any organisms encountered and perhaps saved for body burden analysis.

p. 3-2 Site selection criteria for mussel transplants should eliminate or minimize criteria #s 4 and 5. Criterion #2 seems to imply that sediment sampling stations and mussel transplant stations were located with different objectives, ie."...closer to shore to address potential for groundwater seepage, direct surface water runoff and/or discharge from storm sewer outfalls". It would seem obvious that the different programs will be sampling different environments with different biological receptors, but both methods will be attempting to identify the effects of current and past discharges from HPA. If one of this program's objectives is to evaluate the bioaccumulative potential of storm water, the stations should be located within outfall areas A-I. The likelihood of this program element identifying bioaccumulative constituents from groundwater seepage is extremely remote. Perhaps analysing contaminant body burdens from nearshore benthic organisms and comparing results with sediment and groundwater samples from the area would be more responsive; or simply conducting a 30 day laboratory exposure of appropriate bivalves to collected samples of groundwater.

The proposed 30 day test period is of questionable duration to identify anything but the most gross effects. The daily, monthly, or purely seasonal changes in runoff and groundwater movement and quality will affect study results. If short-term trends are desirable, subsamples of transplanted organisms could be collected in multiples of 30 days.

p. 4-1 The "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms" is an appropriate and useful protocol; however, contrary to the draft, it is not yet being used by the RWQCB to determine "...the acceptability of effluent into SF Bay through the NPDES permitting." The protocol is being required of certain large dischargers for process and toxicity reduction evaluations purposes.

p. 4-2 Stormwater discharges are known to carry significant contaminant loads, yet compositing methods and biological test methods will not be able to identify sources of contaminants, or specific toxic components.
As there are 9 outfall areas (A-I) identified in Figure 3 for HPA, it would

seem inappropriate to restrict the assessment of stormwater quality to only a few. It would seem important to sample and analyze all systems, especially within those which are identified as having multiple sites with historic discharge problems. Each of the 16 identified "Associated sites" should probably be characterized individually, collectively and then determine their influence upon the biota in bay waters through a modified mussel studies program. Chemical analyses should also be conducted on any stormwater sample in which significant mortality (<90 survival) is exhibited.

The analysis of sediments and mussel tissues for heavy metals, certain pesticides and priority organics should be augmented by analysis for benzene, toluene, xylene and Total Petroleum Hydrocarbons to better characterize the source, fate and effects of more commonly encountered petroleum hydrocarbons in the HPA stormwater and groundwater systems.

Discussion

The draft program is a good start, but insufficiently comprehensive or focused to address the many and varied concerns for this site.The avoidance of specific areas in which Triple A or other lessees are currently working is puzzling, and may seriously compromise the value of the assessment.

It appears that major shortcuts or concessions in project design are being sought in the interest of cost savings or as a consequence of serious budget constraints. While such concerns are certainly valid, the consequences in reduced data availability, specificity, ultimate significance and final interpretation and usefulness of the results are put at risk. If the subject draft were outlining a preliminary toxicity and bioaccumulation risk assessment upon which additional phases would be based to respond to specific problems identified, then I could better understand its approach. However, as this is to be a definitive work on the HPA's potential to increase the risk of toxicity and bioaccumulation in adjacent waters, forming the basis for identification and justification of the need for site remediation, then I seriously question if the data will be adequate to address these issues.

No attempt is made to characterize the existing benthic populations within adjacent intertidal and subtidal areas. Knowledge of what is living there now and their accumulation of contaminants of concern would be a logical first step in site evaluation.

It is my opinion that this program could provide an acceptable framework or approach for site evaluation, but needs significant augmentation and revision to make it worthwhile.

If you have any questions on my analysis, or need further clarification, please give me a call.

Michael E. Rugg
Assoc. Water Quality Biologist
Region 3

RESPONSE TO DEPARTMENT OF FISH & GAME COMMENTS ON DRAFT ESAP

Draft Environmental Sampling & Analysis Plan
for Hunters Point Annex
Response to F&G Comments

General Comments:

It is my understanding that the objectives of the draft program are to provide sufficient data to address potential environmental effects associated with the release of contaminants from the subject facility. Page 1-1 of the draft plan explains that this study will supplement previous environmental sampling programs, yet is somewhat vague in its discussion of the specific uses for which the data may be sufficient for decision-making opportunities.

One of the major shortcomings of this effort is its focus away from any current activity which may be subject to an existing regulatory program, i.e. dredging, or evaluation of current site operations at dry dock #4. Another shortcoming is its broad brush approach to risk analysis, based not on the health, or relative contaminant burdens of the local biota, but rather on short-term exposure of transplanted or laboratory animals to composite samples of water and sediments collected from many general areas of the facility and periphery. I question if the data will be "sufficient to address specific environmental concerns..." mentioned on the first page.

Response: **The ESAP Environmental Sampling and Analysis Plan (ESAP) is not intended to be viewed as a complete Ecological Risk Assessment but rather as a preliminary sampling program to evaluate whether discharges from HPA are influencing sediment and water column quality at HPA. Other studies may be required based on the outcome of the results. If sediment chemistry and toxicity testing confirm sediment contamination, the data can be used in the decision making process as to whether further investigations are necessary.**

As discussed at the January 10, 1991 TRC meeting and the January 30, 1991 meeting with the Department of Fish and Game, three test stations in the vicinity of the dry dock (dredged) areas will be included in both the sediment toxicity and bioaccumulation programs to address areas of influence from present uses at HPA. These areas are also addressed in investigations for dredge permit applications, i.e. Environment Science Associates, "Chemical and Bioassay Studies in Support of Maintenance Dredging Permit Application #16685548, Dry Dock #4, Hunters Point Naval Ship Yard," February, 1987.

The toxicity testing methodologies utilized in the ESAP were designed after COE/EPA 1990 "Draft Ecological Evaluation of Proposed Discharge of Dredge Material into Ocean Waters" methods for evaluating the chronic effects of contaminants in sediment on benthic and water-column organisms. The data obtained from laboratory controlled experiments will provide useful, site-specific information regarding whether there is a need to evaluate contaminant burden of the local biota.

Comment: Pg 2-1

The question of sediment toxicity must not be restricted to just near surface deposits. The sediment column deposited since 1869 should be analyzed. While it may be concluded later that remediation of deeper sediments is unnecessary or impractical, the assessment shouldn't be so severely restricted.

Chemical analysis of sediments should be undertaken on all samples, not just those exhibiting greater than 50% mortality in the bioassay. If any "indicator of concern" is applied as a criterion for chemical analysis, "any significant mortality" (greater than that experienced in a valid reference test) would be more appropriate.

Response: **At the January 10, 1991 TRC meeting, several agencies expressed concern that deeper sediment deposits were not adequately addressed in the ESAP. Specifically, they thought that sediments with the potential for exposure through scouring by bottom currents should be investigated further. At the January 30, 1991 meeting with the Department of Fish and Game, this same concern regarding the potential contamination of deeper sediments was reiterated. As a result, a sediment coring program has been added to the sediment toxicity segment of the ESAP. Chemical analysis for metals, semi-volatile organics, pesticides and polychlorinated biphenyls (PCBs), and tributyltin will be conducted on a discrete sediment core sample taken from a depth of 3 feet at each sediment sampling station.**

In addition, in response to agency requests, chemical analysis will be performed on the composite surficial sediment samples and the discrete core sample from each sampling station.

Comment: Pg. 2-2

The exclusion from consideration in test station selection of "Areas of little or no influence from present uses at HPA" or "Areas of little or no influence from potential sources of contamination other than HPA" are unwarranted as they eliminate proper evaluation of historical problems within those areas on the basis of reducing cause and effect conflicts. There may be good reasons for excluding certain areas, but these do not seem appropriate.

Response: **As previously discussed, areas of influence from present uses at HPA will be evaluated through the addition of sampling and mussel transplant stations in the vicinity of the dry dock areas.**

The objective of the ESAP program is to evaluate if contamination is present at HPA which is influencing sediment and water column quality, therefore it is not within the scope of the program to assess areas of influence from potential sources of contamination other than HPA.

Comment: Pg. 2-5

Sediment sampling areas, proposed on Plate 3, appear to be appropriately distributed, but seem excessively large. Compositing 10 subsamples collected within the sample area will likely obscure identification of hot spots and make data interpretation more difficult. I suggest that no more than 3 discrete samples be collected within the proposed sample sites. If greater volume of sediment is needed for chemical and biological tests, more grabs or cores should be taken and perhaps composited. Individual samples as well as composites should be handled and/or composited in a manner which maintains stratigraphic integrity. Sediments should be analyzed in at least 3 distinct regions, i.e., upper 4-5 inches, 5 in. to 2 ft., and 2-10 ft. Additional subsamples should be taken and analyzed if obvious sandblast debris or other changes in sediment characteristic are observed. Bulk sediment analyses are essential for evaluation and interpretation of biological data. Solid phase bioassays could be restricted, if this is a Phase I project, to the surficial sediments, as long as chemical analyses are undertaken on deeper sediments as well as those tested for toxicity.

Sediment compositing and preparation methods should be revised to reflect discrete sampling methods. Screening for benthic invertebrates, discussed as a preliminary step in sample preparation, should be undertaken as soon as possible after collection. This provides an opportunity to identify any organisms encountered and perhaps saved for body burden analysis.

Response: **Sampling sites were selected based on proximity to remedial investigation sites and general proximity to HPA. The 1990 COE/EPA "Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" states the "composite samples represent the average of the characteristics of the individual samples making up the composite and can closely represent the overall characteristics of the entire volume of the material".**

Because the primary objective of the ESAP is to evaluate whether contamination exists in the sediment, composite sampling will be utilized in the surficial sediment sampling program. However, a sediment core sampling program has been added to the ESAP as described above, which includes the collection of discrete sediment samples from the 3 foot depth at each station for chemical analysis. Benthic invertebrates will be screened from the sediment. However, body burden of collected benthic species will not be determined.

Comment: Pg. 3-2

Site selection criteria for mussel transplants should eliminate or minimize criteria #s 4 and 5. Criterion #2 seems to imply that sediment sampling stations and mussel transplant stations were located with different objectives, i.e. "...closer to shore to address potential for groundwater seepage, direct surface water runoff and/or discharge from storm sewer outfalls". It would seem obvious that the different programs will be sampling different environments with different biological receptors, but both methods will be attempting to identify the effects of current and past discharges from HPA. If one of this program's objectives is to evaluate the bioaccumulative potential of storm water, the stations should be located within outfall areas A-I. The likelihood of this program element identifying bioaccumulative constituents from groundwater seepage is extremely remote. Perhaps analyzing contaminant body burdens from near shore benthic organisms and comparing results with sediment and groundwater samples from the area would be more responsive; or simply conducting a 30 day laboratory exposure of appropriate bivalves to collected samples of groundwater.

The proposed 30 day test period is of questionable duration to identify anything but the most gross effects. The daily, monthly, or purely seasonal changes in runoff and groundwater movement and quality will affect study results. If short-term trends are desirable, subsamples of transplanted organisms could be collected in multiples of 30 days.

Response: **As stated in the ESAP in criteria #4 for the selection of mussel transplant stations, the proposed mussel transplant stations are located in areas expected to have little influence from potential sources of contamination other than HPA. It is not within the scope of the ESAP to evaluate other potential sources of contamination in the Bay. In order to set up a feasible mussel transplant program, field practicalities such as the accessibility of the proposed stations for the transplant and retrieval of mussels had to be taken into consideration as stated in criteria #5.**

The objective of the bioaccumulative effects evaluation is to assess the potential for bioaccumulation into mussel tissue of potential contaminants carried by storm water runoff and/or groundwater seepage into San Francisco Bay. In order to adequately assess these potential contaminant pathways, it is necessary to locate the mussel deployment stations closer to shore where the impact of these pathways is likely to be the greatest. Sediment, however, can be carried further from shore impacting organisms in that area, therefore the sediment toxicity stations are necessarily located further off shore.

The selection of mussel transplant station locations was also based on the proximity to areas of known or potential contamination (i.e IR and PA sites and UST locations), and past historical shoreline and berth uses. The stations were, therefore, located near storm water outfalls in closest proximity to these areas with the greatest potential for contaminant runoff. The stations correspond to the stations used in the Harding Lawson Associates Storm Water Quality Study from which additional effluent data from storm water chemical analysis will be available for comparison. These stations were selected to represent the worst case water quality in the storm sewer system. If data from the "worst-case" outfall areas indicates it is appropriate, further investigations can be conducted in other outfall areas.

The objective of the bioaccumulative effects program is to assess whether contaminants are being released from HPA which would not be detected in the water column but may be detected in a bioaccumulator organism such as the mussel. Directly exposing the organisms to groundwater would not accomplish this

goal as the organisms do not live in the groundwater and groundwater is diluted upon entering the bay.

A second 30 day mussel transplant test to be conducted during the wet season has been added to the ESAP to attempt to assess the "worst case scenario" (i.e. maximum storm water runoff and groundwater seepage conditions). As discussed at the January 30, 1991 meeting with the Department of Fish and Game, healthy, non-spawning mussels will be used to maximize their bioaccumulative potential.

According to ASTM protocol, only 28 days is required for bioaccumulation to occur if chemicals are present in the water column. However, it is acknowledged that additional testing may be necessary if the results of the two mussel deployment tests indicate that further testing is appropriate.

Comment: Pg. 4-1

The "Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms" is an appropriate and useful protocol; however, contrary to the draft, it is not yet being used by the RWQCB to determine "...the acceptability of effluent into SF Bay through the NPDES permitting." The protocol is being required of certain large dischargers for process and toxicity reduction evaluations purposes.

Response: **The "Short-term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Marine and Estuarine Organisms" will be utilized only as the protocol for conducting the 3-species chronic bioassays. It will not however, be used to interpret the test results.**

Comment: Pg. 4-2

Storm water discharges are known to carry significant contaminant loads, yet compositing methods and biological test methods will not be able to identify sources of contaminants, or specific toxic components. As there are 9 outfall areas (A-1) identified in Figure 3 for HPA, it would seem inappropriate to restrict the assessment of storm water quality to only a few. It would seem important to sample and analyze all systems, especially within those which are identified as having multiple sites with historic discharge problems. Each of the 16 identified "Associated sites" should probably be characterized individually, collectively and then determine their influence upon the biota in bay waters through a modified mussel studies program. Chemical analyses should also be conducted on any storm water sample in which significant mortality (<90 survival) is exhibited.

The analysis of sediments and mussel tissues for heavy metals, certain pesticides and priority organics should be augmented by analysis for benzene, toluene, xylene and Total Petroleum Hydrocarbons to better characterize the source, fate and effects of more commonly encountered petroleum hydrocarbons in the HPA storm water and groundwater systems.

Response: **The focus of the storm water toxicity evaluation is to determine if the storm water runoff from HPA contains toxic chemicals. If the test results show that, in fact, contamination does exist in the storm water, methods for the determination of the possible source areas will be assessed at that time. Sampling and analysis data from the RI sites will also be useful in contaminant source determinations when evaluated in conjunction with storm water runoff and groundwater flow data. The 16 associated sites will be characterized under the IR program. As stated previously, the storm water sampling stations for the ESAP are the same as those used in the Harding Lawson Associates Storm Water Quality Study. These stations were selected to be representative of what are expected to be representative of worst case water quality in the storm sewer system. Chemical analysis will be performed on composite storm water samples in addition to toxicity testing.**

As discussed at the January 10, 1991 TRC meeting and the January 30, 1991 meeting with the Department of Fish and Game, TPH analytical results are not used directly in the risk assessment. Evaluation of risk is based on the individual chemicals present. Analysis by EPA Method 8270 will include the semi-volatile constituents of total petroleum hydrocarbons (TPHs). Analysis for benzene, toluene, and xylenes is difficult due to their volatile nature. Therefore, in accordance with agency consensus, TPH analysis will not be completed.

Comment: Discussion

The draft program is a good start, but insufficiently comprehensive or focused to address the many and varied concerns for this site. The avoidance of specific areas in which Triple A or other lessees are currently working is puzzling, and may seriously compromise the value of the assessment.

It appears that major shortcuts or concessions in project design are being sought in the interest of cost savings or as a consequence of serious budget constraints. While such concerns are certainly valid, the consequences in reduced data availability, specificity, ultimate significance and final interpretation and usefulness of the results are put at risk. If the subject draft were outlining & preliminary toxicity and bioaccumulation risk assessment upon which additional phases would be based to respond to specific problems identified, then I could better understand its approach. However, as this is to be a definitive work on the HPA's potential to increase the risk of toxicity and bioaccumulation in adjacent waters, forming the basis for identification and justification of the need for site remediation, then I seriously question if the data will be adequate to address these issues.

No attempt is made to characterize the existing benthic populations within adjacent intertidal and subtidal areas. Knowledge of what is living there now and their accumulation of contaminants of concern would be a logical first step in site evaluation.

It is my opinion that this program could provide an acceptable framework or approach for site evaluation, but needs significant augmentation and revision to make it worthwhile.

Response: **Areas on land in which Triple A and other lessees may have contributed to contamination are being investigated under other program elements at HPA. Some ESAP sampling stations are located off shore of Triple A sites.**

As discussed at the January 10, 1991 TRC meeting and the January 30, 1991 meeting with the Fish and Game Department, the ESAP was not intended to be viewed as a comprehensive program in the assessment of ecological risk posed by possible contaminants from HPA, but rather as an initial program, the results of which can be used to assess the need for and design of further test programs. The EPA has requested a comprehensive Ecological Risk Assessment workplan for HPA. Further testing and other components such as wetlands delineation and habitat studies may be incorporated into this workplan.

Community diversity studies were not addressed in the ESAP for several reasons: 1) there is no baseline community diversity studies available for the HPA area. Therefore, there would be no comparable data to assess the health of species found in the sediment, 2) community diversity studies generally take years of investigation to determine temporal and spatial relationships to sediment quality, and 3) experience has shown that the results of such benthic sampling has provided little input into the determination of whether sediments are contaminated. It would appear to the U.S. Navy that a logical first step is to determine if the sediments are contaminated through chemical and toxicity testing.

REGIONAL WATER QUALITY CONTROL BOARD

INTERNAL MEMO

TO: Mark Malinoski, DHS/TSCP DATE: 10/2/90
faxed to Region 1 (8)495-7852

FROM: Tom Gandesbery SUBJECT: TI,HPA

FILE #: 2169.6032

Attached are RWQCB comments on the ESAP. In my absence, Mike Carlin of this office can answer questions regarding our comments. Note that I will be out of the office from October 6 through 27, 1990. We would be happy to discuss these comments with you, the other agencies and the Navy once the report has been reviewed and you have collected all the responses.

In addition, regarding the September 12, 1990, Draft Remedial Action Plan/Closure Plan for the 23 Underground tanks at HPA, I have reviewed the plan and have no comment on its content.

COMMENTS ON DRAFT AMENDMENT TO WORKPLAN,
RI/FS, NAVSTA TREASURE ISLAND, HUNTERS POINT ANNEX
Environmental Sampling and Analysis Plan (ESAP)

GENERAL COMMENTS:

The approach described, as described within the ESAP, for the testing of sediments from Hunters Point Naval Shipyard (HPA) is confusing. It is not clear why the authors selected the testing methods cited. As mentioned below, a new draft of the COA/EPA manual is now available and should be incorporated in the ESAP.

The standard methods utilized, or modified for use in this study should be cited in the ESAP.

Copies of the lab protocol used should be included in the ESAP as should the qualifications and experience of the person(s) conducting the experiments.

A laboratory QA/QC element should be included in the ESAP.

PAGE #	SECTION	
1-1	1.1	Dredging should be reviewed in the context of this report. Maintenance dredging and other "present activities" can not be treated as a separate issue.
1-1	1.2	It will be difficult to link toxicity test to specific chemicals. Rather the focus should be to reduce toxicity. "...due to lack of comparative background information...": Bay-wide studies were conducted by USGS in 1987-88. This should be reviewed and discussed.
1-2	1.4.2	Why are dredge area data not comparable to non-dredge area data? Dry Dock #4 should be included in this study.

2-1	2.1	Chemical analysis should be conducted for all, or a representative sample, of the sediments...not only sediments in which >50% of the organisms die. Compare "background" radiation levels found in Homeporting EIS and incorporated into the sample design. Use the latest version of the EPA-COE Manual: "Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters", 1990.
2-2	2.2.1	Do not avoid the dry dock area; Sediments are mobile. Sampling sites should be based, in part, on topography; therefore, bathometric charts should be reviewed. Older and recent charts should be compared to delineate areas of sediment accretion.
2-3	2.2.2	How does grain size at San Paulo Bay site compare to that at HPA?
	2.3	The Amphipod should be Eohaustoris spp. Delete use of mysid shrimp. These animals usually die from clogged gills.
2-4	2.3.2	Describe and or provide an illustration of a "benthic shovel".
2-4	2.3.3	How will temperature and salinity be monitored? Brine or re-constituted water from Bodega Bay is more desirable than use of artificial sea salts.
2-4 & 2-5		What is the basis for the 20% mortality figure? This figure maybe dependent upon the species of concern (i.e, 10% for hardy species, 20% for fragile species).
2-5	2.4	"Grab sediment samples will be discarded if they are low in volume...": What is the minimum volume? 2.5' is not a surfical sample". Will infauna be screened from sediment samples at the sampling site?

2-6	2.4	Teflon sample containers should be used if sorption by the polyethylene is of concern.
2-6	2.4	"...filled to overflowing, the sediment will be slowly stirred with a glass rod" : This is unacceptable. A more thorough method of sample mixing should be proposed.
2-6	2.5	"Uncontaminated seawater.....will be collected from...San Paulo Bay." : Why is it assumed that San Paulo Bay is "uncontaminated"? It is recommended that seawater be filtered and sterilized using an ultraviolet light unit.
2-7	2.6.1	2nd through 4th Bullet: Sieving for infauna should be conducted at the time of collection. Sample handling should be minimized.
2-7	2.6.3	Why is it proposed that seawater be replaced? Repeated replacement of the seawater will probably result in essentially diluting contaminant levels in both sediment and seawater. Possible contaminants present in sediment pore-water would be replaced and diluted, as would contaminants which have become dissolved in the seawater itself. Additionally, since dissolved contaminants maybe in equilibrium with those on sediment particles, repeated replacement of seawater could result in a effective leaching away of toxicants.
2-8	2.6.7	How will "obvious mortalities" be distinguished from live subjects, especially in the case of the clam?
2-9	2.7	Toxicants found in samples should be included in the table as the relative sensitivity of organism to toxicant is of primary interest.
3-1	3.1	Is the use of mussel stations duplicative with the State's Mussel Watch Program? There is a station located offshore of HPA.
3-1	3.1	Use Mytilus californianus, not M. edulis.
3-1	3.1	last paragraph: how will HPA be linked to substances found in mussels in light of other point and non-point sources along the SF waterfront? Why is the study only

		"qualitative"?
3-5	3.6	Mussels should not be placed in polyethylene bags between the ice chest and deployment.
3-5	3.6	The buoy system should be reevaluated. An inflatable subsurface float sounds flimsy. How will theses buoys be protected from fouling boat propellers?
3-8	3.9.1	Include Percent Lipid Content along with other analysis.
4-4	4.4.3	Why dilute reference water? The species chosen have specific salinity requirements.
	4.5	DHS does NOT certify any labs for chronic toxicity testing.
4-5	4.6.3	"...the results of the remaining dilutions will be discarded." : Results of dilutions should be reported in the results along with the data for the 100% samples.
4-6	4.9	Reference EPA guidance defining an "acceptable test" and depends upon the test. 80 percent survival maybe acceptable in one test and unacceptable in another, depending upon which protocol is used.

hpacmmnt

REGIONAL WATER QUALITY CONTROL BOARD

COMMENTS ON DRAFT AMENDMENT TO WORKPLAN,
RI/FS, NAVAL STATION TREASURE ISLAND, HUNTERS POINT ANNEX
ENVIRONMENTAL SAMPLING AND ANALYSIS PLAN (ESAP)

General Comments:

The approach described, as described within the ESAP, for the testing of sediments from Hunters Point Naval Shipyard (HPA) is confusing. It is not clear why the authors selected the testing methods cited. As mentioned below, a new draft of the COE/EPA manual is now available and should be incorporated in the ESAP. The standard methods utilized, or modified for use in this study should be cited in the ESAP.

Response:

The sediment testing methods utilized in the ESAP were taken from the 1977 COE/EPA "Greenbook". These methods are applicable to the testing of dredged sediments. Because the ESAP includes testing of in place sediments for site characterization, the methods were modified as necessary. The 1990 "Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" has been reviewed and the updated Greenbook protocols have been incorporated in the ESAP where appropriate. The standard methods utilized, or modified for use in this study are cited in the ESAP.

General Comment:

Copies of the lab protocol used should be included in the ESAP as should the qualifications and experience of the person(s) conducting the experiments.

Response:

The lab protocol planned in the ESAP are standard methods described in existing references. Rather than repeat the protocol in the ESAP, the appropriate references are noted in the ESAP.

General Comment:

A laboratory QA/QC element should be included in the ESAP.

Response:

A QA/QC plan has been incorporated into the ESAP.

Comment: Page 1-1, Section 1.1

Dredging should be reviewed in the context of this report. Maintenance dredging and other "present activities can not be treated as a separate issue.

Response: **Sampling stations will be set-up in the vicinity of the dry dock (dredged) areas as agreed upon at the January 10, 1991 Technical Review Committee (TRC) meeting.**

Comment: Page 1-1, Section 1.2

It will be difficult to link toxicity test to specific chemicals. Rather the focus should be to reduce toxicity. "...due to lack of comparative background information...": Bay-wide studies were conducted by USGS in 1987-88. This should be reviewed and discussed.

Response: **The objective of the ESAP is to provide data sufficient to address specific environmental concerns, i.e. the potential environmental effects associated with the release of contaminants from HPA. This information can be incorporated into the RI/FS process where the focus is to reduce toxicity. The chemical analysis of the sample matrices will provide information regarding chemical(s) of concern and their concentrations in the sediments. The 1987-88 USGS bay-wide studies will be reviewed. If appropriate, the pertinent information will be included in the ESAP.**

Comment: Page 1-2, Section 1.4.2

Why are dredge area data not comparable to non-dredge area data?

Dry Dock #4 should be included in this study.

Response: **Previous studies conducted in dredge areas utilized a slightly different testing protocol than the ESAP. The purpose of sampling sediments from the dredged area was to determine the suitability of the sediments for disposal. The purpose of sampling the non-dredged areas is to determine if remediation of the site sediments may be required. Sampling stations will be set up in the vicinity of the dry dock (dredged) areas.**

Comment: Page 2-1, Section 2.1

Chemical analysis should be conducted for all, or a representative sample, of the sediments...not only sediments in which >50% of the organisms die.

Compare "background" radiation levels found in Homeporting EIS and incorporate into the sample design.

Use the latest version of the EPA-COE Manual: "Ecological Evaluation of Proposed Discharge of Dredged Materials into Ocean Waters", 199

Response: **Chemical analysis will be conducted for composite sediments from each station as agreed upon at the January 10, 1991 TRC meeting. In addition, one discrete sediment sample from the 3 foot depth at each station will be chemically analyzed.**

The radiation level information was found in the "Chemical and Bioassay Studies in Support of Maintenance Dredging Permit Application, Dry Dock #4, HPA. No significant levels of radiation were found.

As stated in our response to general comments, the 1990 version of the EPA-COE manual was reviewed and changes were made to the ESAP for consistency with the 1990 manual.

Comment: Page 2-2, Section 2.2.1

Do not avoid the dry dock area; Sediments are mobile.

Sampling sites should be based, in part, on topography; therefore, bathymetric charts should be reviewed. Older and recent charts should be compared to delineate areas of sediment accretion.

Response: **As stated above, sampling stations will be set up in the vicinity of the dry dock areas.**

Sampling sites were selected based on proximity to sites known or suspected of being contaminated and general proximity to HPA. Bathymetric charts will be reviewed, if available, prior to delineating exact locations of the stations.

Comment: Page 2-3, Section 2.2.2

How does grain size at San Pablo Bay site compare to that at HPA?

Response: **It is expected that sediments from the reference locations selected in San Pablo Bay will have a similar grain size distribution to those at HPA. To confirm that the sediments have similar characteristics, preliminary sediment sampling will be conducted at the proposed reference station.**

Comment: Page 2-3, Section 2.3

The Amphipod should be Eohaustoris spp.

Delete use of mysid shrimp. These animals usually die from clogged gills.

Response: **The amphipod species used will be Eohaustoris estuarius. Following general agency consensus agreed upon at the TRC meeting on January 10, 1991, Holmesimysis costata will be used in the solid phase bioassays.**

Comment: Page 2-4, Section 2.3.2

Describe and or provide an illustration of a "benthic shovel".

Response: **A benthic shovel refers to an attachment to the macrophyte net that prevents organisms from 'washing' under the bottom of the sampler during the collection of the organisms. The benthic shovel digs into the substrate increasing collection yield. This text has been added to the ESAP in place of an illustration.**

Comment: Page 2-4, Section 2.3.3

How will temperature and salinity be monitored? Brine or re-constituted water from Bodega Bay is more desirable than use of artificial seasalts.

Response: **Salinity is monitored with a salinity refractometer. Temperature is a continuously recorded on a temperature recorder. As agreed upon at the TRC meeting on January 10, 1991, artificial seawater will be used.**

Comment: Pages 2-4 & 2-5

What is the basis for the 20% mortality figure? This figure maybe dependent upon the species of concern (i.e, 10% for hardy species, 20% for fragile species).

Response: **The 1990 EPA/COE Greenbook specifies that less than 10% mortality in the control test organisms is necessary for the test data to be valid. However, as stated in the comment, mortality may be higher (20%) in more fragile or juvenile organisms. The percent mortality figure will be adjusted, if necessary, in the ESAP for the organisms selected by the agencies at the January 10, 1991 TRC meeting.**

Comment: Page 2-5, Section 2.4

"Grab sediment samples will be discarded if they are low in volume...": What is the minimum volume? 2.5' is not a surficial sample".

Will infauna be screened from sediment samples at the sampling site?

Response: **A minimum volume for sediment grab samples will be considered to be greater than 75% of the sampler volume capacity.**

2.5 feet was included as a liberal estimate of possible sampler penetration depth. Actual penetration depth will probably be several inches depending on the sediment type. Wording in the ESAP has been changed to reflect surficial samples with depth dictated by the bite of the Petersen grab sampler.

Infauna will be screened from the sediment at the sampling site.

Comment: Page 2-6, Section 2.4

Teflon sample containers should be used if sorption by the polyethylene is on concern.

Response: **Glass sample containers with teflon lined screw caps will be used where sorption by polyethylene containers is of concern, i.e. for the semi-volatile organic compounds and the pesticides and PCBs, according to EPA "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 1986 protocol.**

Comment: Page 2-6, Section 2.4

"...filled to overflowing, the sediment will be slowly stirred with a glass rod": This is unacceptable. A more thorough method of sample mixing should be proposed.

Response: **We are not aware of a more thorough method of mixing the sediment. If additional information is available for stirring the sediments, the Navy would appreciate receiving information on the methodology.**

Comment: Page 2-6, Section 2.5

"Uncontaminated seawater.....will be collected from...San Pablo Bay." :Why is it assumed that San Pablo Bay is "uncontaminated"? It is recommended that seawater be filtered and sterilized using an ultraviolet light unit.

Response: **As agreed upon at the January 10, 1991 TRC meeting, artificial seawater will be used.**

Comment: Page 2-7, Section 2.6.1

2nd through 4th Bullet: Sieving for infauna should be conducted at the time of collection. Sample handling should be minimized.

Response: **Sieving for infauna will be conducted at the time of collection. Sample handling procedures will follow 1990 Greenbook protocol.**

Comment: Page 2-7, Section 2.6.3

Why is it proposed that seawater be replaced? Repeated replacement of the seawater will probably result in essentially diluting contaminant levels in both sediment and seawater. Possible contaminants present in sediment pore-water would be replaced and diluted, as would contaminants which have become dissolved in the seawater itself. Additionally, since dissolved contaminants may be in equilibrium with those on sediment particles, repeated replacement of seawater could result in a effective leaching away of toxicants.

Response: **As agreed upon at the January 10, 1991 TRC meeting, seawater will be replaced as per 1990 Greenbook protocol for solid phase bioassays. A liquid suspended particulate phase bioassay will also be conducted to address RWQCB concerns regarding contaminant dilution through water dilution.**

Comment: Page 2-8, Section 2.6.7

How will "obvious mortalities" be distinguished from live subjects, especially in the case of the clam?

Response: **Live organisms will be determined by response to "gentle probing of sensitive parts" as specified in the 1990 Greenbook (s. 10.2.2.4). Abnormal behavior such as the inability to burrow will be considered also. To quantitatively determine between death and paralysis would involve measuring the respiratory rates of the test species which is extremely difficult for the species involved, therefore sublethal effects will not specifically be addressed in the ESAP. As per agency consensus, the clam will not be utilized in bioassay testing.**

Comment: Page 2-9, Section 2.7

Toxicants found in samples should be included in the table as the relative sensitivity of organism to toxicant is of primary interest.

Response: **Analytical data for sediment chemical analysis is likely to be extensive. For example, the analysis for semi-volatile compounds alone involves 67 individual compounds. Due to the extremely large number of chemical constituents involved, it would be difficult to incorporate this information on the same tables as the bioassay data. The chemical data will be presented in tabular form and coded for easy cross-referencing with the bioassay data.**

Comment: Page 3-1, Section 3.1

Is the use of mussel stations duplicative with the State's Mussel Watch Program? There is a station located offshore of HPA.

Response: **The general protocol of the mussel watch program is similar to the State Mussel Watch Program with the major exception that the ESAP mussel transplant program is for a period of 30 days, whereas the State Mussel Watch Program consists of deploying mussels for a much longer period of time (months). The objectives of the State Mussel Watch Program differ significantly from the objectives of the ESAP in that the State program is designed to monitor water quality over a period of time. The ESAP mussel transplant test is designed to predict whether a chemical release is occurring at HPA. According to ASTM protocol, only 28 days is required for bioaccumulation to occur if chemicals are present in the water column. Therefore, although the testing procedures are similar to the State Mussel Watch Program's, the objectives of the programs are different.**

Comment: Page 3-1, Section 3.1

Use Mytilus californianus, not M. edulis,

Response: **The State Mussel Watch Program has used both Mytilus californianus and Mytilus edulis in their test program and considers both species to be acceptable test species. Mytilus californianus will be used however, as agreed upon at the January 10, 1991 TRC meeting.**

Comment: Page 3-1, Section 3.1

Last paragraph: how will HPA be linked to substances found in mussels in light of other point and non-point sources along the SF waterfront? Why is the study only "qualitative"?

Response: **Mussels collected from reference stations in San Francisco Bay will provide a comparative reference for non-point source contaminants in the Bay. The results from these stations will be compared to stations at HPA to evaluate the potential contribution from HPA.**

The primary objective of the mussel transplant program is qualitative in that the program is designed to determine whether bioaccumulative substances are present in the waters surrounding HPA. However, as analysis of mussel tissues from the program will provide quantitative data, i.e. concentrations of bioaccumulative substances in the tissue for comparison with background levels, the study is, in fact, both qualitative and quantitative.

Comment: Page 3-5, Section 3.6

Mussels should not be placed in polyethylene bags between the ice chest and deployment.

Response: **Placing mussels in polyethylene bags between the ice chest and deployment minimizes the risk of contamination of the mussels from boat exhaust or surface film during deployment as outlined in the California State Mussel Watch Program sampling methodology. (Ca. State Mussel Watch Program, 85' - 86', p. A-2). This methodology is still planned for use.**

Comment: Page 3-5, Section 3.6

The buoy system should be reevaluated. An inflatable subsurface float sounds flimsy. How will these buoys be protected from fouling boat propellers?

Response: **The buoy system utilized in the ESAP was designed following the California State Mussel Watch Program mussel transplant system. (Ca. State Mussel Watch Program, 85'-86', p. A-2, A-9). It has been a successful deployment method and will be used for the ESAP.**

Comment: Page 3-8, Section 3.9.1

Include Percent Lipid Content along with other analysis.

Response: **It is true that semivolatile organic compounds are soluble in the lipid fraction of tissue. It is also true that semivolatile compounds sorped to sediment can sometimes be ingested by the species. Metals are not soluble in lipid and therefore will not be concentration in the lipid fraction. It is the intent**

of this study to consider uptake of metals and semivolatiles by the organism based on total body burden analysis for semivolatile compounds and metals. Considering the sensitivity of the analytical methodologies being used, i.e., the low detection levels; the presence of metals and semivolatiles should be detectable in tissue without the lipid extraction procedure.

The Mussel Watch Program does analyze the percent lipid in the test organisms. However, the lipid data is not interpreted with respect to the body burden of the organic constituents in tissue. At this time, we do not believe that the addition of the lipid analysis for tissue will provide additional information in light of the objectives of the mussel deployment study. If significant variance is found in levels of organics in tissue as compared to reference stations, lipid analysis of tissue will be considered.

Comment: Page 4-4, Section 4.4.3

Why dilute reference water? The species chosen have specific salinity requirements.

Response: **As stated in the ESAP, the reference water will be diluted to the same salinity as the stormwater samples. This will be done to provide direct comparison between bioassays performed on the storm and reference water samples. The methodology follows the Draft 1990 Greenbook.**

Comment: Section 4.5

DHS does NOT certify any labs for chronic toxicity testing.

Response: **The reference to DHS certification was included in error and has been removed from the ESAP.**

Comment: Page 4-5, Section 4.6.3

"... the results of the remaining dilutions will be discarded." : Results of dilutions should be reported in the results along with the data for 100% samples.

Response: **The bioassay test results for all test concentrations utilized will be reported.**

Comment: Page 4-6, Section 4.9

Reference EPA guidance defining an "acceptable test" depends upon the test. 80 percent survival may be acceptable in one test and unacceptable in another, depending upon which protocol is used.

Response: **As agreed upon at the TRC meeting on January 10, 1991, the 1990 Draft Greenbook protocol will be followed for the bioassay test conducted. As stated in Section 10.2.2.7, Quality Control Considerations, if less than 10% mortality occurs in the control treatment for a particular test species, the data for that species may be evaluated. Unacceptably high control mortality in the control test indicates that the organisms are being affected by important stresses other than contamination in the material being tested and the test has to be repeated.**

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
OFFICE OF OCEANOGRAPHY AND MARINE ASSESSMENT
OCEAN ASSESSMENTS DIVISION
HAZARDOUS MATERIALS RESPONSE BRANCH
c/o U.S. Environmental Protection Agency (H-8-4)
75 Hawthorne Street
San Francisco, CA 94105

November 7, 1990

Charles W. Flippo
Environmental Protection Specialist (H-6-3)
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

reference: Naval Station Treasure Island, **Hunters Point Annex** Superfund site
Draft Environmental Sampling and Analysis Plan (dated 28 August 1990)

Dear Mr. Flippo:

The U.S. Department of Commerce/National Oceanic and Atmospheric Administration (NOAA), as a Federal trustee for natural resources, appreciates the opportunity to review and comment on the Draft *Environmental Sampling and Analysis Plan for Naval Station, Treasure Island, Hunters Point Annex, San Francisco, California* (dated 28 August 1990). NOAA carries out responsibilities as a Federal trustee for natural resources under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Contingency Plan (NCP). As a trustee, NOAA is responsible for identifying sites that could affect natural resources, evaluating the injury to the resources, determining dollar values (when appropriate) for resource loss, and providing technical advice on remedial and restoration actions.

In summary, the Draft Environmental Sampling and Analysis Plan (ESAP) addresses potential environmental effects associated with the release of contaminants from the Hunters Point Annex site to San Francisco Bay and is designed to supplement on-going and planned remedial investigations of potential contamination at specific identified sites on base. Bioassays will be used to evaluate the acute toxicity of site-related contaminants to organisms in contact with Bay sediments and storm water runoff. Transplanted mussels will be used to monitor the release of bioaccumulating contaminants via groundwater discharge and surface runoff. Criteria used to select sampling locations, procedures to be followed, tests to be performed, and how test results will be interpreted are clearly defined. Overall, the ESAP should provide some valuable data regarding the extent and impact of the contamination in the near shore areas and in the storm runoff, however, NOAA does have some important recommendations, both specific and general, for improvements to the draft ESAP. These comments are outlined below.

2.0 TASK 1 - EVALUATION OF SEDIMENT TOXICITY

Section 2.1 Statement of Purpose

While it is commendable that bioassays are proposed in the evaluation of this site, it must be recognized that the bioassay tests that are currently available are limited in their ability to respond to the presence of all contaminants that may be of concern. A good example of this situation is the fact that PCBs are generally a problem primarily because they accumulate in tissues of higher organisms (including humans). PCBs are not, however, acutely toxic to most aquatic organisms. The test protocol proposed might not detect high levels of such substances in the sediments because they would not elicit the requisite bioassay response. In addition, while bioavailability of the substances present in the sediments may vary, it is usually the chemical levels in an area that are used to define the spatial extent of the areas that need to be cleaned up, if any. Comparisons among the bioassay responses and the chemical levels, including areas where the bioassay tests were unresponsive, will be important in making those decisions.

Section 2.2.1 Selection of Test Station Areas

The dry dock area, between proposed Sediment Station Areas S-4 and S-5, should not be excluded from sampling. Minimally, two more sediment test station areas in this vicinity should be established: one station offshore of Dry Docks #2 and #3, and another station offshore of Dry Dock #4.

Section 2.2.2 Selection of Reference Station Area

If a reference area for sediment investigations is to be chosen from within the greater San Francisco Bay system, San Pablo Bay is, indeed, probably the best choice. It should be noted, however, that virtually all reaches of the San Francisco Bay estuary have been impacted by one source of contamination or another. The proposed reference sampling area within San Pablo Bay should be located precisely on a chart and be mindful of the following criteria:

- avoid the navigation channel to Mare Island;
- be east of Pinole Point and north of Wilson Point; and,
- avoid the area southwest of the Petaluma River.

Section 2.3.1 Selection of Test Species

A number of the organisms selected for the sediment and surface runoff bioassays are inappropriate for determining if contaminants in sediments are likely to affect NOAA resources. The bentnose clam (*Macoma nasuta*), a pollution-tolerant organism, is typically used in bioaccumulation studies rather than in acute bioassays. Similarly, the worm species selected, *Nephtys caecoides*, is considered to be relatively insensitive to pollution compared to other species. Because of their pollution tolerance, these species would not be the best indicators of potentially toxic conditions in the sediments.

In place of the bentnose clam test, it is suggested that the bivalve larvae bioassay -- a much more sensitive test -- be used. Larvae of either the oyster (*Crassostrea gigas*) or the Bay mussel (*Mytilus edulis*) are employed as the test organisms and a well-established protocol

is available[1]. A chronic bioassay using the marine worm, *Neanthes* sp., considered to be more sensitive than *Nephtys caecoides*, has recently become available and is recommended instead of the latter[2]. If the worm tests cannot be used, then it is recommended that the solid phase/elutriate form of the echinoderm fertilization test be substituted[3].

Also, the amphipod *Ampelisca millerilabdita*, although found in San Francisco Bay, may not be the best organism for indicating toxicity of test sediments. Because this specie of amphipod constructs a tube within its burrow, it does not come into direct contact with the sediments. For this reason it is suggested that either of the amphipods *Rhepoxynius abronius* or *Eohaustorius estuarius* be used instead of *Ampelisca* spp. Both of these species burrow into the sediments. *Rhepoxynius* can be used when the salinity is 25 parts per thousand (ppt) or greater while *Eohaustorius* is useful when salinities range from 3 to 25 ppt. Test protocols with these organisms are also well established.

Section 2.4 Sediment Sampling Procedures

The workplan proposes to store the sediments from the offshore bioassay survey until the results of those tests are completed in order to select only the "toxic" samples for chemical analyses. This procedure may jeopardize the sample integrity because allowable holding times may be exceeded for many of the substances of concern. As noted above, it is recommended that chemical analyses be performed on all of the sediment samples, in part to avoid the holding time problem.

Section 2.8 Statistical Analysis and Interpretation of Results

The endpoint suggested for determining that a response has occurred in the bioassays may be too conservative. Toxicity would be better represented by any response that varies *statistically* from the control, e.g., statistically greater mortality.

The ESAP does not detail what will happen if Cochran's Test for Homogeneity of Variances shows that the hypothesis of equal variances for the analysis of variance (ANOVA) is to be rejected. A description should be included in the ESAP of how statistical analyses will be handled if assumptions for the ANOVA are invalidated.

Section 2.9 Chemical Analytical Confirmation

The detection limits proposed in the ESAP exceed levels associated with adverse biological effects for some of the contaminants being analyzed (Table 5. CLP Analytical Methods for Sediment Analyses). The units are given as µg/kg for organics. The detection limits to be

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[1] Chapman, P. and F. Ecker. 1986. Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments. Puget Sound Estuary Program, U.S. Environmental Protection Agency, Seattle, WA; 55 pp.

[2] PTI. 1988. Puget Sound Dredge Disposal Analysis Sublethal Test Demonstration. U.S. Army Corps of Engineers, Seattle District; October 1988; 94 pp.

[3] Dinnel, P., J. Link, and Q. Stober. 1987. Improved Methodology for a Sea Urchin Sperm Cell Bioassay for Marine Waters. Archives Environmental Contamination Toxicology 16: 23 - 32.

used for PCBs and some pesticides exceed sediment levels associated with adverse biological effects (ER-L values)[4]:

	Detection limit (mg/kg)	ER-L (mg/kg)
PCB	0.08	0.05
Endrin	0.016	0.00002
p,p-DDE	0.016	0.002
p,p-DDD	0.016	0.002
p,p-DDT	0.016	0.001

The detection limits for inorganic substances in sediments are given in units of µg/l. This reporting of sediment inorganic contaminant concentrations in µg/l is confusing unless, however, it is the interstitial waters which are being analyzed. If the units are indeed µg/l, then the detection limits are too high in comparison to Ambient Water Quality Criteria (AWQC):

	Detection Limit (µg/l)	AWQC value (µg/l)
Copper	10	2.9
Mercury	0.2	0.025
Silver	10	2.3

Typically, sediment contaminant concentrations are reported as mg/kg. Associated detection limits should be sufficiently low to permit comparison with adverse biological effects levels (ER-L values):

	ER-L value (mg/kg)
Antimony	2
Arsenic	33
Cadmium	5
Chromium	80
Copper	70
Lead	35
Mercury	0.15
Nickle	30
Silver	1
Zinc	120

[4] Long, E.R., and L.G. Morgan. 1990. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, March 1990; National Oceanic and Atmospheric Administration, Seattle, WA; 175 pp. + appendices.

3.0 TASK 2 - EVALUATING WHETHER PERSISTENT AND BIOACCUMULATIVE SUBSTANCES MAY BE ENTERING SAN FRANCISCO BAY FROM HPA

Section 3.1 Statement of Purpose

Task 2 is designed to evaluate whether persistent and bioaccumulative substances may be entering the Bay. Essentially, this section of the ESAP is a pathway analysis employing filter feeding bivalves. There may be other potential bioaccumulation pathways operating within this system (e.g., benthic feeding fish) and these possibilities should also be considered.

It should be recognized that the potential contaminant migration pathways being examined in Task 2 -- groundwater seepage, direct surface water runoff, and discharge from storm sewer outfalls -- vary over the period of a year, and from year to year as well. The 30-day test period selected for mussel deployment should coincide with an anticipated worst case scenario for the migration pathways being examined (i.e., a period of significant rainfall). Regardless of what 30-day test period is selected for mussel deployment, if analyses results demonstrate contaminant bioaccumulation, then it will be known that bioaccumulative substances are present in the waters surrounding Hunters Point Annex. If, however, the analyses results are inconclusive or negative for bioaccumulated contaminants for a particular 30-day test period, it can not be concluded that bioaccumulative substances are not or will not be present in the waters surrounding Hunters Point Annex at other times during the year. Therefore, it is recommended that if the first 30-day test period has inconclusive or negative results, then additional 30-day intervals, representing different precipitation and runoff conditions, be tested.

Section 3.2 Selection of Mussel Transplant Stations

The dry dock area, between proposed Mussel Transplant Stations M-4 and M-5, should not be excluded from testing. Minimally, two more mussel transplant stations in this vicinity should be established: one station offshore of Dry Docks #2 and #3, and another station offshore of Dry Dock #4.

Section 3.3 Selection of Test Species

The ESAP is proposing to use the Bay mussel (*Mytilus edulis*) as the test specie and to harvest transplant mussel stock from Bodega Head. Two complications arise from this choice. First, the comparative database for Bay mussel is significantly limited. Second, it is unlikely that Bay mussels will be found at Bodega Head. Bodega Head is a good source for "clean" California mussels (*Mytilus californianus*). The Bay mussel, however, is found farther away from Bodega Head in the quieter harbor area and the probability of harvesting "unclean" transplant stock increases the closer the mussels are to the harbor. Tomales Bay would probably be a better source for clean Bay mussels than Bodega Harbor. The California mussel, mentioned as an alternative test species in the ESAP, would actually be the preferred test specie.

Section 3.4 Determination of Size of Test Population

Typically, the California State Mussel Watch Program deploys their test mussels between August and January to reduce potential mortality of the test mussels due to reduced salinity associated with precipitation and runoff. If test mussels at Hunters Point are to be deployed outside the August - January time period, the sample size used in the bioaccumulation study should be increased to compensate for potential mortality among the test mussels. The present sample size (40 mussels, with no replicate) does not allow for mortality which may occur during the experiment, since 15 mussels are needed for the metal analysis, 20 for the organic analysis, and 5 for radioactive screening. It is recommended that the number of mussels used at each station be increased to at least 50, particularly if the mussels are deployed between February and July.

4.0 TASK 3 - EVALUATION OF STORM WATER RUNOFF TOXICITY

Section 4.3 Selection of Test Species

The three species proposed for use in the runoff bioassays are sensitive marine or estuarine species. In the proposed storm water runoff bioassay, concentrations of 1, 3, 10, 30, and 100 percent runoff are to be used. Dilution water will be prepared with deionized water and either artificial sea salts or concentrated Bodega Bay water to achieve the same salinity as the storm water samples. The dilution water will be used in the five dilution series and a control. However, the test organisms could be physiologically stressed due to low salinity under some runoff conditions. Since the low salinity stress could be greater than that due to toxic levels of contaminants within the runoff, care should be taken ensure that salinities in the tests are appropriate for the organisms.

If the salinity is very low in the storm water runoff bioassays, it is suggested that freshwater organisms be substituted for those originally proposed. Rainbow trout (*Oncorhynchus mykiss*), the freshwater invertebrate *Ceriodaphnia dubia*, and the freshwater alga *Selanastrum* spp. could be used as alternative test species.

Other General Comments

- The ESAP does not discuss remediation, however, data collected during the environmental assessment would be incorporated into the remedial investigations at the individual sites. Integrating these data meaningfully back into the Remedial Investigations/Feasibility Studies for the designated Operable Units will be difficult. If sediment chemistry and toxicity testing confirm sediment contamination, consideration should be given to creating a separate Operable Unit of the Bay shore and sediments.

- While Task 1 of the ESAP is designed to examine acute lethality in the evaluation of sediment toxicity, sublethal effects are all but ignored. There is mention in Section 2.6.8 (page 2-9) that sublethal effects such as paralysis will be recorded, however, there is no plan for a comprehensive evaluation of sublethal effects of the sediments. The larger and sometimes more difficult question of potential chronic environmental effects will remain unanswered.

- It should be recognized that this ESAP alone does not constitute and should not take the place of a more comprehensive Ecological Assessment of the potential environmental impacts of contaminants at Hunters Point Annex. U.S. Environmental Protection Agency guidance documents for designing, implementing, and interpreting Ecological Assessments at hazardous waste sites were cited in Section 1.2 "Scope of Plan" and in the "References" section of the ESAP and it is recommended that such an Ecological Assessment of Hunters Point Annex be designed and implemented. This ESAP would become a component of a more comprehensive Ecological Assessment.

- A formal wetland delineation[5] should be conducted at Hunters Point Annex. An emergent wetland, characterized by saltmarsh vegetation, exists along a strip of shoreline approximately 30 m wide in the industrial landfill area.

- If sediment chemistry and toxicity testing confirm sediment contamination in the selected near shore test areas, it is recommended that a second phase of such testing be planned and implemented for new test areas more distant from the shore.

If you have any questions about these comments or require further elaboration, I can be reached at 744-2317.

Sincerely,

Chip Demarest
Coastal Resources Coordinator

cc: William C. Allan (U.S. DOI/OEA, San Francisco)
Robin Kohn (NOAA/GCSW, Terminal Island)
Richard Powell (Navy/WESDIV, San Bruno)
Steve Schwarzbach (USFWS, Sacramento)

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[5] Federal Interagency Committee for Wetland Delineation. 1989. Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S.D.A. Soil Conservation Service; Washington DC Cooperative Technical Publication; 76 pp. + appendices.

RESPONSE TO NOAA COMMENTS ON DRAFT ESAP

Draft Environmental Sampling & Analysis Plan
for Hunters Point Annex
Response to NOAA Comments

2.0 TASK 1 - EVALUATION OF SEDIMENT TOXICITY

Comment: Section 2.1 Statement of Purpose

While it is commendable that bioassays are proposed in the evaluation of this site, it must be recognized that the bioassay tests that are currently available are limited in their ability to respond to the presence of all contaminants that may be of concern. A good example of this situation is the fact that PCBs are generally a problem primarily because they accumulate in tissues of higher organisms (including humans). PCBs are not, however, acutely toxic to most aquatic organisms. The test protocol proposed might not detect high levels of such substances in the sediments because they would not elicit the requisite bioassay response. In addition, while bioavailability of the substances present in the sediments may vary, it is usually the chemical levels in an area that are used to define the spatial extent of the areas that need to be cleaned up, if any. Comparisons among the bioassay responses and the chemical levels, including areas where the bioassay tests were unresponsive, will be important in making those decisions.

Response: **As agreed upon at the Technical Review Committee (TRC) meeting on January 10, 1991, composite sediment samples at each station will undergo chemical analysis to address the concerns of NOAA and other agencies.**

Comment: Section 2.2.1 Selection of Test Station Areas

The dry dock, between proposed Sediment Station Areas S-4 and S-5, should not be excluded from sampling. Minimally, two more sediment test station areas in this vicinity should be established: one station offshore of Dry Docks #2 and #3, and another station offshore of Dry Dock #4.

Response: **Three additional sampling stations in the vicinity of the dry dock areas have been included in the ESAP as agreed upon at the TRC meeting on January 10, 1991.**

Comment: Section 2.2.2 Selection of Reference Station Area

If a reference area for sediment investigations is to be chosen from within the greater San Francisco Bay system, San Pablo Bay is, indeed, probably the best choice. It should be noted, however, that virtually all reaches of San Francisco Bay estuary have been impacted by one source of contamination or another. The proposed reference sampling area within San Pablo should be located precisely on a chart and be mindful of the following criteria:

- avoid the navigation channel to Mare Island;
- be east of Pinole Point and north of Wilson Point; and,
- avoid the area southwest of the Petaluma River.

Response: **The ESAP has been revised to include reference and control sediment stations. San Pablo Bay will be used for the collection of control station sediments. The location of the control area within San Pablo Bay will be recorded by Loran coordinates and located precisely on a nautical chart. The proposed control station area is shown on Plate 6 in the ESAP. NOAA recommendations of areas to avoid in the location of the control area are noted and these areas will be avoided. Two reference stations have been added in San Francisco Bay. Their planned locations are also shown on Plate 6.**

Comment: Section 2.3.1 Selection of Test Species

A number of the organisms selected for the sediment and surface runoff bioassays are inappropriate for determining if contaminants in sediments are likely to affect NOAA resources. The bentnose clam (*Macoma nasuta*), a pollution-tolerant organism, is typically used in bioaccumulation studies rather than in acute bioassays. Similarly, the worm species selected, *Nephtys caecoides*, is considered to be relatively insensitive to pollution compared to other species. Because of their pollution tolerance, these species would not be the best indicators of potentially toxic conditions in the sediments.

In place of the bentnose clam test, it is suggested that the bivalve larvae bioassay - a much more sensitive test - be used. Larvae of either the oyster (*Crassostrea gigas*) or the Bay mussel (*Mytilus edulis*) are employed as the test organisms and a well-established protocol is available. A chronic bioassay using the marine worm, *Neanthes* sp., considered to be more sensitive than *Nephtys caecoides*, has recently become available and is recommended instead of the latter. If the worm tests cannot be used, then it is recommended that the solid phase/elutriate form of the echinoderm fertilization test be substituted.

Also, the amphipod *Ampelisca milleri/abdita*, although found in San Francisco Bay, may not be the best organism for indicating toxicity of test sediments. Because this species of amphipod constructs a tube within its burrow, it does not come into direct contact with the sediments. For this reason it is suggested that either of the amphipods *Rhepoxynius abronius* or *Eohaustorius estuarius* be used instead of *Ampelisca* spp. Both of these species burrow into the sediments. *Rhepoxynius* can be used when the salinity is 25 parts per thousand (ppt) or greater while *Eohaustorius* is useful when salinities range from 3 to 25 ppt. Test protocols with these organisms are also well established.

Response: **In accordance with the general agency consensus reached at the TRC meeting on January 10, 1991, the following species will be utilized in the ESAP:**

1. **The use of bentnose clam (Macoma nasuta) test will be deleted.**
2. **Eohaustorius sp. will replace the amphipod Ampelisca milleri/abdita**
3. **A Nephtys species will be used in the solid phase bioassays**
4. **Holmesimysis costata will be used for the solid phase bioassays and the liquid/suspended particulate phase bioassays**
5. **C. Stigmaes will be used in the liquid/suspended particulate phase bioassays**
6. **A bivalve larvae will be used in the liquid/suspended particulate phase bioassays.**

Comment: Section 2.4 Sediment Sampling Procedures

The workplan proposes to store the sediments from the offshore bioassay survey until the results of those tests are completed in order to select only the "toxic" samples for chemical analyses. This procedure may jeopardize the sample integrity because allowable holding times may be exceeded for many of the substances of concern. As noted above, it is recommended that chemical analyses be performed on all of the sediment samples, in part to avoid the holding time problem.

Response: **As agreed upon at the January 10, 1991 TRC meeting, chemical analysis will be performed on composite sediment samples collected at each station.**

Comment: Section 2.8 Statistical Analysis and Interpretation of Results

The endpoint suggested for determining that a response has occurred in the bioassays may be too conservative. Toxicity would be better represented by any response that varies *statistically* from the control, e.g., statistically greater mortality.

The ESAP does not detail what will happen if Cochran's Test for Homogeneity of Variances shows that the hypothesis of equal variances for the analysis of variance (ANOVA) is to be rejected. A description should be included in the ESAP of how statistical analyses will be handled if assumptions for the ANOVA are invalidated.

Response: **The 1990 EPA/COE "Draft Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" states that differences between control and test survival should be equal to or greater than 10% before predictions of probable field impacts can be made. A statistical analysis of benthic bioassay data will be conducted to determine the 'strength of evidence' for concluding that the test material samples are significantly more toxic to marine benthic infauna than are the control sediment samples.**

If Cochran's Test for Homogeneity of Variances shows that the hypothesis of equal variances for the analysis for variance (ANOVA) is rejected, then Steel's Many-One Rank Test or Wilcoxin Rank Sum Test with Bonferroni Adjustment will be utilized.

Comment: Section 2.9 Chemical Analytical Confirmation

The detection limits proposed in the ESAP exceed levels associated with adverse biological effects for some of the contaminants being analyzed (Table 5. CLP Analytical Methods for Sediment Analyses). The units are given as μg/kg for organics. The detection limits to be used for PCBs and some pesticides exceed sediment levels associated with adverse biological effects (ER-L values).

Detection limit (mg/kg)		ER-L (mg/kg)
PCB	0.08	0.05
Endrin	0.016	0.00002
p,p-DDE	0.016	0.002
p,p-DDD	0.016	0.002
p,p-DDT	0.016	0.001

The detection limits for inorganic substances in sediments are given in units of μg/l. This reporting of sediment inorganic contaminant concentrations in μg/l is confusing unless, however, it is the interstitial waters which are being analyzed. If the units are indeed μg/l, then the detection limits are too high in comparison to Ambient Water Quality Criteria (AWQC):

Detection Limit (μg/l)	AWOC value (μg/l)
Copper 10	2.9
Mercury 0.2	0.025
Silver 10	2.3

Typically, sediment contaminant concentrations are reported as mg/kg. Associated detection limits should be sufficiently low to permit comparison with adverse biological effects levels (ER-L values):

ER-L value (mg/kg)	
Antimony	2
Arsenic	33
Cadmium	5
Chromium	80
Copper	70
Lead	35
Mercury	0.15
Nickel	30
Silver	1
Zinc	120

Response: The detection limits reported in Table 5 of the ESAP are CLP levels required in the Superfund program.

Detection limits for inorganic substances in sediments were incorrectly reported as µg/l. Inorganic detection limits will be revised and reported in mg/Kg, in the ESAP.

3.0 TASK 2 - EVALUATING WHETHER PERSISTENT AND BIOACCUMULATIVE SUBSTANCES MAY BE ENTERING SAN FRANCISCO BAY FROM HPA

Comment: Section 3.1 Statement of Purpose

Task 2 is designed to evaluate whether persistent and bioaccumulative substances may be entering the Bay. Essentially, this section of the ESAP is a pathway analysis employing filter feeding bivalves. There may be other potential bioaccumulation pathways operating within this system (e.g., benthic feeding fish) and these possibilities should also be considered.

It should be recognized that the potential contaminant migration pathways being examined in Task 2 - groundwater seepage, direct surface water runoff, and discharge from storm sewer outfalls - vary over the period of a year, and from year to year as well. The 30-day test period selected for mussel deployment should coincide with an anticipated worst case scenario for the migration pathways being examined (i.e., a period of significant rainfall). Regardless of what 30-day test period is selected for mussel deployment, if analyses results demonstrate contaminant bioaccumulation, then it will be known that bioaccumulative substances are present in the waters surrounding Hunters Point Annex. If, however, the analyses results are inconclusive or negative for bioaccumulated contaminants for a particular 30-day test period, it can not be concluded that bioaccumulative substances are not or will not be present in the waters surrounding Hunters Point Annex at other times during the year. Therefore, it is recommended that if the first 30-day test period has inconclusive or negative results, then additional 30-day intervals, representing different precipitation and runoff conditions, be tested.

Response: A second 30-day test period has been added to the ESAP, one deployment period will be during the wet season and the second will be during the dry season.

Comment: Section 3.2 Selection of Mussel Transplant Stations

The dry dock area, between proposed Mussel Transplant Stations M-4 and M-5, should not be excluded from testing. Minimally, two more mussel transplant stations in this vicinity should be established: one station offshore of Dry Docks #2 and #3, and another station offshore of Dry Dock #4.

Response: Three additional mussel deployment stations have been established in the vicinity of the Dry Dock areas.

Comment: Section 3.3 Selection of Test Species

The ESAP is proposing to use the Bay mussel (*Mytilus edulis*) as the test specie and to harvest transplant mussel stock from Bodega Head. Two complications arise from this choice. First, the comparative database for Bay mussel is significantly limited. Second, it is unlikely that Bay mussels will be found at Bodega Head. Bodega Head is a good source for "clean" California mussels (*Mytilus californianus*). The Bay mussel, however, is found farther away from Bodega Head in the quieter harbor area and the probability of harvesting "unclean" transplant stock increases the closer the mussels are to the harbor. Tamales Bay would probably be a better source for clean Bay mussels than Bodega Harbor. The California mussel, mentioned as an alternative test species in the ESAP, would actually be the preferred test specie.

Response: Mytilus californianus **will be utilized as the test species in the mussel transplant program as agreed at the January 10, 1991 TRC meeting. The test organisms will be collected from Bodega Head.**

Comment: Section 3.4 Determination of Size of Test Population

Typically, the California State Mussel Watch Program deploys their test mussels between August and January to reduce potential mortality of the test mussels due to reduced salinity associated with precipitation and runoff. If test mussels at Hunters Point are to be deployed outside the August-January time period, the sample size used in the bioaccumulation study should be increased to compensate for potential mortality among the test mussels. The present sample size (40 mussels, with no replicate) does not allow for mortality which may occur during the experiment, since 15 mussels are needed for the metal analysis, 20 for the organic analysis, and 5 for radioactive screening. It is recommended that the number of mussels used at each station be increased to at least 50, particularly if the mussels are deployed between February and July.

Response: **The sample size per mussel station will be increased to 50 to compensate for potential mortality among the test mussels.**

4.0 TASK 3 - EVALUATION OF STORM WATER RUNOFF TOXICITY

Comment: Section 4.3 Selection of Test Species

The three species proposed for use in the runoff bioassays are sensitive marine or estuarine species. In the proposed storm water runoff bioassay, concentrations of 1,3, 10, 30, and 100 percent runoff are to be used. Dilution water will be prepared with deionized water and either artificial sea salts or concentrated Bodega Bay water to achieve the same salinity as the storm water samples. The dilution water will be used in the five dilution series and a control. However, the test organisms could be physiologically stressed due to low salinity under some runoff conditions. Since the low salinity stress could be greater than that due to toxic levels of contaminants within the runoff, care should be taken to ensure that salinities in the tests are appropriate for the organisms.

If the salinity is very low in the storm water runoff bioassays, it is suggested that freshwater organisms be substituted for those originally proposed. Rainbow trout (*Oncorhynchus mykiss*), the freshwater invertebrate *Ceriodaphnia dubia*, and the freshwater alga *Selanastrum* spp. could be used as alternative test species.

Response: **Tidal waters are known to back up into HPA storm water drainage systems during some storm events. Marine species were chosen for the storm water toxicity tests as higher salinities encountered were thought to be more stressful to fresh water organisms. Harding Lawson Associates conducted storm water sampling during a storm water event on December 14 and 15, 1990. The salinity results of this storm water sampling event will be evaluated when they become available. In addition, salinity measurements will be taken during storm water toxicity sampling. If necessary, the organisms used for storm water toxicity tests will be changed to those most appropriate for salinities found in storm water runoff at HPA.**

Other General Comments

- The ESAP does not discuss remediation, however, data collected during the environmental assessment would be incorporated into the remedial investigations at the individual sites. Integrating these data meaningfully back into the Remedial Investigations/Feasibility Studies for the designated Operable Units will be difficult. If sediment chemistry and toxicity testing confirm sediment contamination, consideration should be given to creating a separate Operable Unit of the Bay shore and sediments.

- While Task 1 of the ESAP is designed to examine acute lethality in the evaluation of sediment toxicity, sublethal effects are all but ignored. There is mention in Section 2.6.8 (page 2-9) that sublethal effects such as paralysis will be recorded, however, there is no plan for a comprehensive evaluation of sublethal effects of the sediments. The larger and sometimes more difficult question of potential chronic environmental effects will remain unanswered.

- It should be recognized that this ESAP alone does not constitute and should not take the place of a more comprehensive Ecological Assessment of the potential environmental impacts of contaminants at Hunters Point Annex. U.S. Environmental Protection Agency guidance documents for designing, implementing, and interpreting Ecological Assessments at hazardous waste sites were cited in Section 1.2 "Scope of Plan" and in the "References" section of the ESAP and it is recommended that such an Ecological Assessment of Hunters Point Annex be designed and implemented. This ESAP would become a component of a more comprehensive Ecological Assessment.

- A formal wetland delineation should be conducted at Hunters Point Annex. An emergent wetland, characterized by saltmarsh vegetation, exists along a strip of shoreline approximately 30 m wide in the industrial landfill area.

- If sediment chemistry and toxicity testing confirm sediment contamination in the selected near shore test areas, it is recommended that a second phase of such testing be planned and implemented for new test areas more distant from the shore.

Response:

- **The ESAP is a preliminary sampling program to evaluate whether discharges from HPA are influencing sediment quality and the water column quality at HPA. Other studies may be required based on the outcome of the results. If sediment chemistry and toxicity testing confirm sediment contamination, further investigations will be considered at that time and depending on the results, it may be recommended to create a separate operable unit for the bay shore and sediments.**

- **As agreed upon at the January 10, 1991 TRC meeting, sublethal effects on test organisms will not be addressed as part of the ESAP.**

- **It is recognized that the ESAP does not constitute a comprehensive Ecological Risk Assessment. As recommended by the U.S. Environmental Protection Agency at the TRC meeting, the Navy will present an Ecological Risk Assessment workplan at some time in the future. The ESAP would then become a component of the Ecological Risk Assessment.**

- **As discussed at the TRC meeting January 10, 1991, a wetland delineation will be addressed in an Ecological Risk Assessment workplan to be compiled rather than in the ESAP.**

- **A second phase of testing will be planned and implemented if sediment chemistry and toxicity testing confirm sediment contamination in the selected ESAP test areas.**

EPA COMMENTS ON
DRAFT ENVIRONMENTAL SAMPLING AND ANALYSIS PLAN
FOR HUNTERS POINT ANNEX

GENERAL COMMENTS

1. The plan excludes the dredged areas. These should be included in the study. Studies conducted as part of the USS Missouri Homeporting project found that the most contaminated sediments lay in the deeper strata proposed for dredging in the project. These materials were shown to have severe toxic effects on organisms even in some of the less sensitive types of tests (i.e., the Liquid/Suspended Particulate Phase test). Therefore, maintenance dredging which periodically removes only surface and near-surface material cannot be assumed to be remediating the sediment contamination problem. In fact, depending on the configuration of the area being dredged, slumping of deeper material along the edges of the side slope cuts of the berth(s) may result in increased exposure of contaminated material to the aquatic environment.

2. Additional discussion of the rationale for determining the number of sample areas and samples from each area should be included in Sections 2-2 and 4.2.

3. We have several comments on QA/QC-related issues:

There is no information on sample containers and preservatives required for each type of sample. A table summarizing the sample locations, the number and types of samples at each location, the sample matrices, the sample containers and preservatives, and analytical methods needed for each sample should be developed to aid in the review of the plan and to assist the field personnel.

A Request for Analyses table indicating the number of samples and matrices of the sample, required analytical procedures, required holding times, and the number of QC samples should be developed to aid the laboratory.

Field measurements should be described in detail. These descriptions should include radioactivity, as well as bioassay water quality parameters (pH, temperature, etc.). In addition, the calibration procedures and frequency of field instrumentation should be discussed.

The disposal of contaminated materials should be discussed.

Decontamination procedures should be discussed in greater detail. Will equipment be decontaminated after each sample?

There is no discussion on sample handling and shipment. In addition, there is insufficient discussion of sample packaging. The following information is needed:

a. How will samples be labeled and identified?
b. Will custody seals be used?
c. How will the samples be packaged to prevent cross-contamination and breakage?
d. What are the sample handling procedures?
e. What tracking forms and packing lists will be used?

There is no discussion of the required QC samples. The number, frequency, types, and sample locations where they should be obtained are not discussed. The use of duplicates, blanks, and laboratory QC samples should be discussed in detail. This should also address the laboratory blanks. If this information is addressed in the QAPjP, this can be referenced.

4. There is no site safety plan.

[EPA recognizes that some of the matters addressed in comments # 3 and 4 above may be addressed in other volumes of the RI/FS Workplan for Hunters Point. If that is the case, appropriate cross-references should be made in the ESAP. Where the RI/FS Workplan does not adequately address matters specific to the ESAP, the ESAP should expand on the Workplan. For example, safety of the field personnel involved in collection of samples under the ESAP may not be adequately addressed in the overall Site Safety Plan.

In general, EPA believes it is beneficial to develop stand-alone documents for the benefit of field personnel. That is, it is awkward for field personnel to have to cross reference several volumes of reports to determine what they need to do in the field. Therefore, we recommend that information needed by field personnel to carry out the ESAP be included in this document (or other stand-alone documents), even if that involves some duplication from earlier HPA RI/FS workplans.]

SPECIFIC COMMENTS

5. Page 2-1, Section 2.1, first paragraph. Please provide a rationale for defining "surficial" as the upper 2.5 feet. Also, why are only acute effects from sediment contamination being investigated when water column studies (Mussel transplants) are testing for chronic effects? If sediment contaminants are bioavailable, one might expect both acute and chronic effects. At a minimum, 28-day sediment accumulation studies as described in the 1990 Draft EPA/Corps of Engineers Greenbook should be considered.

Second paragraph. It is not clear why previous testing at Hunter's Point for the purpose of permitting dredged material disposal will not be comparable to the sediment testing proposed in this ESAP. The methodology will be similar and a comparison may serve to relate contamination levels at non-dredged sites to contamination levels from dredging projects around the Bay. This could place the sediments in context with "industrial background" levels from nearby areas.

Last paragraph. Although EPA's Ocean Dumping Program is not yet authorized to use the 1990 Draft Greenbook for sediment testing for dredged material disposal, this manual contains many updated procedures which the program has been requiring for several years under its Regional Testing Guidance. Therefore, we recommend that sampling and testing procedures follow the 1990 Draft Greenbook because it more accurately reflects state-of-the-art sediment testing procedures. In addition, revisions to the Greenbook before it becomes final are expected to be minimal.

The objectives of dredged material testing are to determine the effects of the material's disposal both to the water column and to benthic organisms once it has been deposited on the bottom. The objective of the Solid Phase Bioassay is to indicate the magnitude of benthic effects of the material and so does not differ from the objective of the sediment toxicity testing proposed in the ESAP.

6. Page 2-3, Section 2.3.1. Clams are not an appropriate bioassay test organism as they can close up and survive from 14 to 30 days without physiological damage. Macoma nasuta, though not appropriate for toxicity testing, may be an appropriate species for bioaccumulation testing. The amphipod selected is sensitive to low salinities and is a suspension feeder, not a deposit feeder. Neomysis is not appropriate for a solid-phase bioassay but is for a suspended solid-phase bioassay.

The EPA Region IX Ocean Dumping Program recommends the following species for its solid phase bioassay testing:

Neanthes sp. or Nephtys sp.
Holmesimysis costata (formerly Acanthomysis sculpta)
Rhepoxynius abronius or Ampelisca abdita

The SF Bay Regional Water Quality Control Board suggests that the amphipod Eohaustoris spp. be substituted for Rhepoxynius or Ampelisca as it is a more appropriate species for Bay testing.

7. Page 2-4, Section 2.3.2, first paragraph. How will a "known uncontaminated field location" be determined?

We recommend the following:

- Sieve through a 0.5 mm screen;
- Transfer organisms with large diameter pipettes, not forceps;
- Decrease the amount of handling: one at capture, one at test;
- Use prepared seawater. (See also following comment.)

8. Page 2-4, Section 2.3.3. If artificial sea water is used, it must be held and filtered for 10 days before the bioassay organisms are exposed to it.

Should the acclimation period of two weeks be defined prior to the start of the bioassay? Starting the bioassay when there has been no organism mortality for a number of days may be another way to establish the length of the acclimation period.

9. Page 2-5, last paragraph. Indicate where the reference sample will come from.

10. Page 2-6, Section 2.5, second paragraph. By using prepared seawater, there will be no uncertainties about the water quality "purity" of the water above the reference sediment sample.

Third paragraph. The static-renewal schedule should be constructed so that 75% replacement should occur every 48 hours, as referenced in the 1990 Greenbook.

11. Page 2-7, Section 2.6.1. Use a 0.5 mm sieve screen.

12. Page 2-7, last paragraph. The organisms should not be stressed by water replacement if DO, pH, salinity, and temperature are constant. Since these factors should be constant, stressed organisms should be an indicator of "pollutants" in the sediments.

Delete the following comment per phon con btwn. EPA Chuck Flippo/WESTON Julie Carver of 14 NOV. 1990

13. Page 2-7, Section 2.6.3. Why use 5 replicate tanks for each station? The control is the contractor's reference to compare the dilution series to.

14. Page 2-8, Section 2.6.5. While placing more than one species of organism in a testing tank is acceptable, placement of Nephtys sp. or Neanthes sp. in the same tank as the amphipod is not recommended.

15. Page 2-8, Section 2.6.6. Removal of dead organisms during an "acclimation" period is not a valid procedure for this type of test. The sediments, as a body, are being tested and therefore dead organisms indicate non-healthy sediments if all procedures are followed prior to the beginning of the tests.

Conduct the bioassays at home range temperature and salinity. There should be no changes.

16. Page 2-9, Section 2.6.7. Maintain DO at a minimum of 5 ppm.

17. Page 2-9, Section 2.6.8. What criteria will be used to determine a paralyzed worm, amphipod, or clam from a recently dead one?

18. Page 2-9, Section 2.7. According to the QA/QC procedures presented in the 1990 Greenbook, if **control** mortality is greater than 10% the test is invalidated. Because of background contamination levels in San Francisco Bay it is conceivable that **reference** mortality could be greater than 10%. This, however, would not invalidate the test.

19. Page 2-9, Section 2.8. Statistical analysis of the testing results should consist of Levine's test for homogeneity of variances, an Analysis of Variance and Dunnett's test for multiple comparisons of means as outlined in the 1990 Greenbook.

20. Page 2-9, Section 2.9. Statistically significant mortality could occur even if the percent mortality is less than 50%. Chemical analyses of sediment should be performed for all stations with statistically significant mortality in the solid phase bioassay at a minimum.

21. Page 2-10, Section 2.9 and page 3-8, Section 3.9. What is the rationale for the determination of the chemical analytical parameters? Considering that diesel fuel and other hydrocarbon fuels and oils were used extensively on-site, why are there no analyses planned for total petroleum hydrocarbons (TPH)?

22. Page 2-10, Section 2.9, last paragraph. EPA and the Corps of Engineers are currently recommending the method suggested in the 1990 Greenbook (Rice et.al, 1987; Greenbook page 9-8) for analysis of Tributyltin for ocean disposal dredged material testing.

23. Page 2-11, Section 2-10, top bullet. Again, greater than 10% mortality in the control replicate will invalidate the bioassay. Greater than 10% mortality in the reference replicate may be cause for concern but would not necessarily invalidate the test.

24. Page 3-1, Section 3-1. What was the rationale for using Mytilus edulis instead of Mytilus californianus? If interlaboratory calibration will be done with the State Mussel Watch (SMW) or another CDFG laboratory, it will be necessary to use M. californianus for comparison.

25. Page 3-2, Section 3.2. Why avoid the dry dock area? Is it isolated so that no water flows to the rest of HPA?

26. Page 3-5, Section 3.6. If the contractor is planning to use a transplant period of only 30 days, how will they compare the tissue analysis data with the SMW?

27. Page 3-7, 6th bullet. How will "visible growth" be determined if no measurements are taken prior to initiation of the testing program?

28. Page 3-9, Section 3.9.4. The measurement of tributyltin using the GS/FPD method is fine if good derivitization is used. To make the compound more volatile, the Grignard derivitization step followed by the GS/FPD method should be used.

29. Page 3-9, 2nd bullet. We also recommend collecting mussels in the area of HPA for a 3-level comparison: "uncontaminated" background, "existing" conditions at HPA, and increases in contaminated tissue levels compared to 1 and 2.

30. Page 3-9, Section 3.11. What are the QA/QC criteria for the tissue sample analysis?

31. Page 4-1. The test species identified are marine, not brackish water, organisms. The test organisms should be brackish water species.

32. Page 4-3, Section 4.3. Change the selection criteria to reflect the salinity of the testing media.

33. Page 4-3, Section 4.3. D. excentricus spawns from April to October, so this species cannot be used until Spring. Sea urchins, which spawn from October to April, are usually used.

34. Page 4-4, Sections 4.4.3 and 4.4.4. Why take a reference sample and dilute it to match the storm water sample? We recommend using artificial sea salt as San Pablo Bay water may be "contaminated" from river runoff during the wet season.

35. Page 4-5, Section 4.6.2, 1st bullet. The test organisms selected prefer cold water (approximately 10°C) and test temperature should be within 1°C of the habitat of concern (winter water temperatures are not that warm). Refer to page 2-8, 2nd paragraph, also.

36. Page 4-6, Section 4.7.3. There is a more accurate protocol for S. costatum than the modified algae test. Refer to **Bioassay Procedures for Ocean Disposal Permit Program,** EPA publication 600/9-78-010.

37. Plates. The sample map should indicate the direction of ground water and surface water flow.

RESPONSE TO EPA COMMENTS ON DRAFT ESAP

Draft Environmental Sampling & Analysis Plan
for Hunters Point Annex
Response to EPA Comments

Comment #1: The plan excludes the dredged areas. These should be included in the study. Studies conducted as part of the USS Missouri Homeporting project found that the most contaminated sediments lay in the deeper strata proposed for dredging in the project. These materials were shown to have severe toxic effects on organisms even in some of the less sensitive types of tests (i.e., the Liquid/Suspended Particulate Phase test). Therefore, maintenance dredging which periodically removes only surface and near surface material cannot be assumed to be remediating the sediment contamination problem. In fact, depending on the configuration of the area being dredged, slumping of deeper material along the edges of the side slope cuts of the berth(s) may result in increased exposure of contaminated material to the aquatic environment.

Response: Additional sampling stations will be located in the vicinity of the dry dock areas to address dredged areas. At the Technical Review Committee (TRC) meeting on January 10, 1991, it was agreed that the ESAP would be limited to surficial sampling. However, we have included core samples taken to a depth of 3 feet for chemical analysis at each sampling station in response to subsequent agency request for deeper sampling.

Comment #2: Additional discussion of the rationale for determining the number of sample areas and samples from each area is included in Sections 2-2 and 4.2.

Response: Additional discussion of the rationale used for determining the number of sample areas and samples from each area is included in Sections 2-2 and 4.2.

Comment 3: We have several comments on QA/QC-related issues: There is no information on sample containers and preservatives required for each type of sample. A table summarizing the sample locations, the number and types of samples at each location, the sample matrices, the sample containers and preservatives, and analytical methods needed for each sample should be developed to aid in the review of the plan and to assist the field personnel.

A Request for Analyses table indicating the number of samples and matrices of the sample, required analytical procedures, required holding times, and the number of QC samples should be developed to aid the laboratory.

Field measurements should be described in detail. These descriptions should include radioactivity, as well as bioassay water quality parameters (pH, temperature, etc.). In addition, the calibration procedures and frequency of field instrumentation should be discussed.

The disposal of contaminated materials should be discussed.

Decontamination procedures should be discussed in greater detail. Will equipment be decontaminated after each sample?

There is no discussion on sample handling and shipment. In addition, there is insufficient discussion of sample packaging. The following information is needed:

a. How will samples be labeled and identified?

b. Will custody seals be used?

c. How will the samples be packaged to prevent cross-contaminated and breakage?

d. What are the sample handling procedures?

e. What tracking forms and packing lists will be used?

There is no discussion of the required QC samples. The number, frequency, types, and sample locations where they should be obtained are not discussed. The use of duplicates, blanks, and laboratory QC samples should be discussed in detail. This should also address the laboratory blanks. If this information is addressed in the QAPJP, this can be referenced.

Response #3: **A comprehensive QA/QC plan is included in the ESAP to address each of the items requested.**

Comment #4: There is no site safety plan.

EPA recognizes that some of the matters addressed in comments #3 and 4 above may be addressed in other volumes of the RI/FS Workplan for Hunters Point. If that is the case, appropriate cross-references should be made in the ESAP. Where the RI/FS Workplan does not adequately address matters specific to the ESAP, the ESAP should expand on the Workplan. For example, safety for the field personnel involved in collection of samples under the ESAP may not be adequately addressed in the overall Site Safety Plan.

[In general, EPA believes it is beneficial to develop stand-alone documents for the benefit of field personnel. That is, it is awkward for field personnel to have to cross reference several volumes of reports to determine what they need to do in the field. Therefore, we recommend that information needed by field personnel to carry out the ESAP be included in this document (or other stand-along documents), even if that involves some duplication from earlier HPA RI/FS workplans.]

Response #4: **A specific Site Safety Plan is being developed for the ESAP. The Site Safety Plan will be prepared as a separate document for field use.**

Comment #5: Page 2-1, Section 2.1, first paragraph.

Please provide a rational for defining "surficial" as the upper 2.5 feet. Also, why are only acute effects from sediment contamination being investigated, when water column studies (Mussel transplants) are testing for chronic effects? If sediment contaminants are bioavailable, one might expect both acute and chronic effects. At a minimum, 28-day sediment accumulation studies as described in the 1990 Draft EPA/Corps for Engineers Greenbook should be considered.

Second paragraph.

It is not clear why previous testing at Hunter's Point for the purpose of permitting dredged material disposal will not be comparable to the sediment testing proposed in this ESAP. The methodology will be similar and comparison may serve to relate contamination levels at non-dredged sites to contamination levels from dredging projects around the Bay. This could place the sediments in context with "industrial background" levels from nearby areas.

Last paragraph.

Although EPA's Ocean Dumping Program is not yet authorized to use the 1990 Draft Greenbook for sediment testing for dredged material disposal, this manual contains many up-dated procedures which the program has been requiring for several years under its Regional Testing Guidance. Therefore, we recommend that sampling and testing procedures follow the 1990 Draft Greenbook because it more accurately reflects state-of-the-art sediment testing procedures. In addition, revisions to the Greenbook before it becomes final are expected to be minimal.

The objectives of dredged material testing are to determine the effects of the material's disposal both to the water column and to benthic organisms once it has been deposited on the bottom. The objective of the Solid Phase Bioassay is to indicate the magnitude of benthic effects of the material and so does not differ from the objective of the sediment toxicity testing proposed in the ESAP.

Response #5: **2.5 feet was included as a liberal estimate of possible sampler penetration depth. Actual penetration depth will probably be several inches depending on the sediment type. Wording has been changed to reflect surficial samples with depth dictated by the bite of the Petersen grab sampler.**

Based on the life expectancy of the invertebrates being used in the sediment tests, some of the bioassays may be considered chronic or subchronic. Mussel transplant studies are neither acute or chronic effects but bioaccumulative effects. These effects can be manifested within days.

Second paragraph: **As discussed at the TRC meeting on January 10, 1991, three stations will be located in the vicinity of the dry dock (dredged) areas. Previous studies conducted in dredge areas utilize a slightly different testing protocol than the ESAP. The purpose of sampling sediments from dredged areas was to determine the suitability of the sediment for disposal. The purpose of the sampling of the non-dredged areas is to determine if remediation of the site may be required. The data from non-dredge area stations will be compared to data obtained from the stations in the vicinity of the dry docks areas and to reference station data. However, variable testing conditions (i.e. the use of different test organisms or bioassay tests) and physical parameters of the test areas (i.e. sediment grain size) at other dredge projects around the Bay could make it difficult to compare the HPA sediment data with "industrial background" levels from nearby areas. It was for this reason, reference stations are included in the ESAP.**

Last paragraph: **Sampling and testing procedures will follow the 1990 draft Greenbook for sediment testing of dredged material disposal, where possible. However, because the objectives of the Dredge Disposal Program is different than the ESAP objectives, modifications to the Greenbook protocols were made in the ESAP. The protocols discussed in the ESAP for control, reference and sediment additions to test tanks will remain the same.**

The objectives of the dredged material testing program is to determine the suitability of depositing dredged material on clean sediments. The objectives of the solid phase bioassays is to determine the suitability of leaving sediment in place that has already been deposited. However, both types of studies have toxicity of the sediment to test species as a common endpoint of the test. The effects of the tests are the same, but the objectives are dissimilar.

Comment #6: Page 2-3, Section 2.3.1.

Clams are not an appropriate bioassay test organism as they can close up and survive from 14 to 30 days without physiological damage. Macoma nasuta, though not appropriate for toxicity testing, may be an appropriate species for bioaccumulation testing. The amphipod selected is sensitive to low salinities and is a suspension feeder, not a deposit feeder. Neomysis is not appropriate for a solid-phase bioassay but is for a suspended solid-phase bioassay.

The EPA Region IX Ocean Dumping Program recommends the following species for its solid phase bioassay testing:

Neanthes sp. or Nephtys sp.
Holmesimysis costata (formerly Acanthomysis sculpta)
Rhepoxynius abronius or Ampelisca abdita

The SF Bay Regional Water Quality Control Board Suggests that the amphipod Eohaustoris spp. be substituted for Rhepoxynius or Ampelisca and it is a more appropriate species for Bay testing.

Response #6: Macoma nasuta will be eliminated as a bioassay test organism.
In addition, as agreed upon by the agencies at the January 10, 1991 TRC meeting, the following species will be used as the test organisms for the solid phase and liquid suspended particulate phase bioassays.

Liquid Suspended Particulate Phase	10 Day Chronic Bioassay - Solid Phase
Crassostrea gigas or	
Mytilus edulis	Eohaustoris estuarius
Holmesimysis costata	Holmesimysis costata
Citharichthys stigmaes	Nephtys caecoides

Comment #7: Page 2-4, Section 2.3.2, first paragraph

How will a "known uncontaminated field location" be determined?

We recommend the following:

- Sieve through a 0.5 mm screen;
- Transfer organisms with large diameter pipettes, not forceps;
- Decrease the amount of handling: one at capture, one at test;
- Use prepared seawater. (See also following comment.)

Response: The test species for these bioassays will be purchased from suppliers of proposed test organisms. The areas where the test species will be collected will be "known" uncontaminated areas based on the collector's knowledge and experience.

Test organism collection will be conducted in accordance with 1990 EPA/COE Greenbook protocol for the collection and handling of test organisms.

Comment #8: Page 2-4, Section 2.3.3

If artificial seawater is used, it must be held and filtered for 10 days before the bioassay organisms are exposed to it.

Should the acclimation period of two weeks be defined prior to the start of the bioassay? Starting the bioassay when there has been no organism mortality for a number of days may be another way to establish the length of the acclimation period.

Response: **Suppliers instructions for the preparation of artificial seawater include a 24-hour holding period during which time the artificial seawater will be filtered and aerated. This is considered as a standard preparation procedure for artificial seawater for use in aquatic toxicity bioassays. No information could be located in the 1990 Greenbook indicating that this standard procedure is not acceptable. Should control tests indicate problems with the prepared seawater which result in unacceptably high control mortality, seawater preparation techniques can be revisited at this time.**

The 1990 draft Greenbook states on page 10-20, Section 10.2.2.1 that animals collected from the field should be held no longer than necessary preferably for no more than 10 days (preferably 7) before they are used in testing. Therefore, the bioassays will commence within 10 days of collection of the test organisms, as recommended in the Greenbook.

Comment #9: Page 2-5, last paragraph

Indicate where the reference sample will come from.

Response: **The ESAP has been revised to include reference and control sediment stations. The control sediment sample will be obtained from San Pablo Bay. The specific location of the control site in San Pablo Bay will be determined based on preliminary sediment sampling to determine compatibility of the sediment grain size in the proposed control site in San Pablo Bay with grain sizes at HPA as determined in previous studies. Areas from which potential control station samples will be collected is shown on Plate 6 in the ESAP. Reference stations have been selected in San Francisco Bay and are also shown on Plate 6.**

Comment #10: Page 2-6, Section 2.5, Second Paragraph

By using prepared seawater, there will be no uncertainties about the water quality "purity" of the water above the reference sediment sample.

Third paragraph: The static-renewal schedule should be constructed so that 75% replacement should occur every 48-hours, as referenced in the 1990 Greenbook.

Response: **Prepared seawater will be used as agreed upon at the January 10, 1991, TRC meeting.**

Third paragraph: As stated in Sections 2.5 and 2.6.1.3, the static-renewal schedule is constructed such that 75% replacement occurs every 48-hours.

Comment #11: Page 2-7, Section 2.6.1

Use a 0.5 mm sieve screen.

Response: **A 0.5 mm sieve screen will be used**

Comment #12: Page 2-7, last paragraph

The organisms should not be stressed by water replacement if DO, pH, salinity, and temperature are constant. Since these factors should be constant, stressed organisms should be an indicator of "pollutants" in the sediments.

Response: **In accordance with 1990 Greenbook protocol, Section 10.2.2 for benthic bioassays, the sentence has been changed to "the frequency of water changes will be increased if acceptable water quality cannot be maintained".**

Comment #13: Page 2-7, Section 2.6.3

Why use five (5) replicate tanks for each station? The control is the contractor's reference to compare the dilution series to.

Response: **Comment was deleted as per phone conversation between EPA (Chuck Flippo) and WESTDIV (Julie Carver) on November 14, 1990.**

Comment #14: Page 2-8, Section 2.6.5

While placing more than one species of organism in a testing tank is acceptable, placement of Nephtys sp. or Neanthes sp. in the same tank as the amphipod is not recommended.

Response: **Nephtys sp. will not be placed in the same tank as the amphipod.**

Comment #15: Page 2-8, Section 2.6.6

Removal of dead organisms during an "acclimation" period is not a valid procedure for this type of test. The sediments, as a body, are being tested and therefore dead organisms indicate non-health sediments if all procedures are followed prior to the beginning of the tests.

Conduct the bioassays at home range temperature and salinity. There should be no changes.

Response: **The procedure of removing dead organisms and replacing them with healthy organisms during the acclimation period in reference/control sediment outlined in the 1977 COE/EPA Greenbook has been changed. The 1990 COE/EPA draft manual (Greenbook), in Section 10.2.2.4, states that prior to testing, the test animals should be divided randomly among finger bowls, or other suitable intermediate containers, equal in number to the number of exposure chambers in the test. Twenty individuals of each species are to be randomly placed in each container with water of the same temperature and salinity and from the same source as the water being used in the test. After 30 minutes any dead animals or animals exhibiting unusual behavior are to be removed and replaced with healthy individuals. If obvious mortalities exceed 10 percent during this period, the test is discontinued and a new test begun. Species selection, collection and holding techniques should be reexamined to reduce unacceptably high mortality in the new test. However, this procedure has been deleted from the ESAP following EPA's recommendation.**

Bioassays will be conducted under conditions known to be non-stressful to the test organisms as per 1990 Greenbook protocol. The temperature and salinity of the waters from which the test organism were collected are considered to be non-stressful to the test organisms and will be used as the "home" range temperature and salinity.

Comment #16: Page 2-9, Section 2.6.7

Maintain DO at a minimum of 5 ppm.

Response: **The ESAP stipulates that DO will be maintained at a minimum of 5 ppm.**

Comment #17: Page 2-9, Section 2.6.8

What criteria will be used to determine a paralyzed worm amphipod, or clam from a recently dead one?

Response: **The ESAP will use mortality as an indicator rather than address sublethal effects. Mortality will be determined by response of the organisms to gentle probing of sensitive body part as per 1990 Greenbook protocol. Test organisms exhibiting sublethal effects such as paralysis will be counted as a mortality if the organism is non-responsive to probing of sensitive parts.**

Comment #18: Page 2-9, Section 2.7

According to the QA/QC procedures presented in the 1990 Greenbook, if control mortality is greater than 10% the test is invalidated. Because of background contamination levels in San Francisco Bay it is conceivable that reference mortality could be greater than 10%. This however, would not invalidate the test.

Response: **The Navy agrees with your comment. Not all information presented in the Greenbook is applicable to the objectives of the study. If control mortality is greater than 10%, acceptable control mortality will be determined after the bioassays are complete using appropriate statistical analysis acceptable to the aquatic toxicology profession. Reference mortalities can exceed 10% without invalidating the test.**

Comment #19: Page 2-9, Section 2.8

Statistical analysis of the testing results should consist of Levine's test of homogeneity of variances, and Analysis of Variance and Dunnett's test for multiple comparisons of means as outlined in the 1990 Greenbook.

Response: **Statistical analysis of the testing results may consist of Levine's test for homogeneity of variances, an Analysis of Variance and Dunnett's test for multiple comparisons of means as outlined in the 1990 Greenbook. However, the data provided by the bioassays may dictate other appropriate statistical analysis of the data not discussed in the Greenbook. Other statistical analysis of the data will be considered where appropriate.**

Comment #20: Page 2-9, Section 2.9

Statistically significant mortality could occur even if the percent mortality is less than 50%. Chemical analyses of sediment should be performed for all stations with statistically significant mortality in the solid phase bioassay at a minimum.

Response: **As agreed upon at the January 10, 1991 TRC meeting, composite sediment samples from each station will undergo chemical analysis. In addition, a discrete deeper sample from the 3 foot depth interval at each station will be chemically analyzed.**

Comment #21: Page 2-10, Section 2.9 and page 3-8, Section 3.9

What is the rationale for the determination of the chemical analytical parameters? Considering that diesel fuel and other hydrocarbon fuels and oils were used extensively onsite, why are there no analysis planned for total petroleum hydrocarbons (TPH)?

Response: **Sample analysis by EPA Method 8270 will include the semi-volatile constituents of TPHs. The risk assessment will be based on TPH constituents present rather than the TPH level, therefore it was agreed at the January 10, 1991, TRC meeting that TPH analysis need not be completed.**

Comment #22: Page 2-10, Section 2.9, last paragraph

EPA and the Corps of Engineers are currently recommending the method suggested in the 1990 Greenbook (Rice et. al, 1987; Greenbook page 9-8) for analysis of tributyltin for ocean disposal dredged material testing.

Response: **A commercial laboratory will be performing the tributyltin analysis. The tributyltin analysis methods utilized by the laboratory are n-Pentyl Derivatization with Gas Chromatography/Flame Photometric Detection.**

Comment #23: Page 2-11, Section 2-10, top bullet

Again, greater than 10% mortality in the control replicate will invalidate the bioassay. Greater than 10% mortality in the reference replicate may be cause for concern but would not necessarily invalidate the test.

Response: **Wording has been changed to "A 10 percent or greater average control mortality (less than 90% survival) will potentially invalidate the bioassay results". Statistical analysis completed on the bioassay data will be used to determine the acceptability of control mortality. Reference mortalities greater than 10% will not invalidate bioassay results.**

Comment #24: Page 3-1, Section 3-1

What was the rationale for using Mytilus edulis instead of Mytilus californianus? If inter-laboratory calibration will be done with the State Mussel Watch (SMW) or another CDFG laboratory, it will be necessary to use M. californianus for comparison.

Response: **Mytilus californianus will be used in the mussel transplant program, as agreed at the TRC meeting on January 10, 1991.**

Comment #25: Page 3-2, Section 3.2

Why avoid the dry dock area? Is it isolated so that no water flows to the rest of HPA?

Response: **As agreed upon at the January 10, 1991 TRC meeting, three sampling stations have been added to the ESAP in the vicinity of the dry dock areas.**

Comment #26: Page 3-5, Section 3.6

If the contractor is planning to use a transplant period of only 30 days, how will they compare the tissue analysis data with the SMW?

Response: **The objective of the State Mussel Watch Program differs significantly from the objectives of the ESAP in that the State program is designed to monitor water quality changes over a period of time. The ESAP mussel transplant test is designed to evaluate whether contaminants are being released from sites at HPA. Bioaccumulation studies of this type require only a 30 day exposure of the test species according to ASTM protocol.**

Comment #27: Page 3-7, 6th bullet

How will "visible growth" be determined if no measurements are taken prior to initiation of the testing program?

Response: **Section 3.5 - Collection of Mussels from Uncontaminated Area states that "mussels collected for transplant will be between 55 and 65 mm in length" implying that the mussels will be measured upon collection to ensure that they meet the size requirements. A sentence has been added to the ESAP stating that mussel size will be measured and recorded upon collection for later determination of visible growth following mussel deployment.**

Comment #28: Page 3-9, Section 3.9.4

The measurement of tributyltin using the GS/FPD method is fine if good derivatization is used. To make the compound more volatile, the Grignard derivitization step followed by the GS/FPD method should be used.

Response: **A commercial laboratory will be performing the tributyltin analysis. The analysis methodology utilized will will be Gas Chromatography/Flame Photometric Detection with n-Pentyl Derivatization.**

Comment #29: Page 3-9, 2nd bullet

We also recommend collecting mussels in the area of HPA for a 3-level comparison: "uncontaminated" background, "existing" conditions at HPA, and increases in contaminated tissue levels compared to 1 and 2.

Response: **Mussels in the HPA vicinity, if any, are most likely to be located on the piers where they would be subject to bilge water pump out. Assessing the impact of transient vessels at the site is not within the scope of this project and the analysis results would not be comparable to the mussel station data.**

Comment #30: Page 3-9, Section 3.11

What are the QA/QC criteria for the tissue sample analysis?

Response: **QA/QC protocol for tissue analysis will be obtained from the laboratory performing the analysis and included in the Quality Assurance Project Plan (QAJPP).**

Comment #31: Page 4-1

The test species identified are marine, not brackish water organisms. The test organisms should be brackish water species.

Response: **As agreed upon in January 10, 1991, TRC Meeting, the organisms used in the stormwater toxicity tests will be changed to those most appropriate for salinities found in stormwater at HPA at the time of sampling.**

Comment #32: Page 4-3, Section 4.3

Change the selection criteria to reflect the salinity of the testing media.

Response: **Final species selection will be based on the salinity of in the stormwater at the time of testing. This criteria has been added to Section 4.3.**

Comment #33: Page 4-3, Sections 4.3

D. excentricus spawns from April to October, so this species cannot be used until spring. Sea urchins, which spawn from October to April, are usually used.

Response: **If D. excentricus is not an appropriate species for the testing time period, the sea urchin will be substituted.**

Comment #34: Page 4-4, Sections 4.4.3 and 4.4.4

Why take a reference sample and dilute it to match the stormwater sample? We recommend using artificial seasalt as San Pablo Bay water may be "contaminated" from river runoff during the wet season.

Response: **Artificial seawater will be used as control water as agreed upon at TRC meeting, January 10, 1991. The salinity will match that of the storm water sampled.**

Comment #35: Page 4-5, Section 4.6.2, 1st bullet

The test organisms selected prefer cold water (approximately 10° C) and test temperature should be within 1° C for the habitat of concern (winter water temperatures are not that warm). Refer to page 2-8, 2nd paragraph, also.

Response: **Tests will be conducted under conditions known to be non-stressful to the test organism. The temperature selected will approximate the temperature where the organism was collected, rather than the habitat of concern.**

Comment #36: Page 4-6, Section 4.7.3

There is a more accurate protocol for S. costatum than the modified algae test. Refer to Bioassay Procedures for Ocean Disposal Permit Program, EPA publication 600/9-78-010.

Response: **As agreed to in the TRC meeting on January 10, 1991, the same protocol for 3-species chronic bioassays required for dischargers by the San Francisco Regional Water Quality Control Board will be utilized.**

Comment #37: Plates

The sample map should indicate the direction of groundwater and surface water flow.

Response: **Plates: The sample map has been changed to include available information regarding the direction of groundwater and surface water flow.**

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
Office of Environmental Affairs
Box 36098 - 450 Golden Gate Avenue
San Francisco, California 94102
(415) 556-8200

November 2, 1990

Mr. Charles W. Flippo
U.S. Environmental Protection Agency
75 Hawthorne Street (H-6-3)
San Francisco, CA 94105

Dear Mr. Flippo,

I am commenting on the Navy's proposed environmental risk assessment for the Hunter's Point Annex under which they consider the effects of past contamination and proposed remediation activities upon the natural environment. In particular, I am commenting on plans as presented to the Ecological Assessment Group meeting at Ft. Cronkhite on October 26, 1990.

Since the Hunter's Point property appears to contain salt marsh wetlands, it is appropriate for the Navy to have a formal wetlands delineation conducted. Additionally, Habitat Evaluation Procedures should be utilized to determine the productivity of the wetlands and ensure that important habitat values are not lost during remediation. Similarly, the Navy must comply with the Endangered Species Act to ensure that remediation does not affect any listed species or critical habitat.

Indications have been received that sediments in the vicinity of the dry docks have been contaminated with TBT, copper sulphate and other toxic materials, and these sediments are acutely toxic to aquatic life.

The Navy appeared to indicate, on October 24 at the Technical Review Committee and October 25 at the Ecological Assessment Group, that they feel it is unnecessary to assess contamination in areas not subject to dredging. However, they might have contributed to contamination of the sediment and and should assess all contamination on their property. Evaluation of the alternative treatment means, including no action, should be conducted subsequent to determination of contamination.

Similarly, the Navy should survey and compare benthic organisms in sediment areas with appropriate reference areas to determine the general health of the aquatic communities. Sterile sediments may be indicators of the presence of acute toxicants.

I continue my interest in the proposed remediation actions at Hunter's Point. If you have any questions concerning my comments, please contact me at (415) 556-8200.

Thank you for your consideration.

Sincerely,

William C. Allan
Regional Environmental Assistant

cc: Mark Malinowski, CA DHS
Chip Demarest, NOAA
Tom Maurer, FWS

RESPONSE TO US DEPARTMENT OF INTERIOR COMMENTS ON DRAFT ESAP

USDOI Comments on the Draft Environmental Sampling and Analysis Plan (ESAP)
for Hunters Point Annex - 28 August 1990
Response to USDOI Comments

Comment A:

I am commenting on the Navy's proposed environmental risk assessment for the Hunters Point Annex under which they consider the effects of past contamination and proposed remediation activities upon the natural environment. In particular, I am commenting on plans as presented to the Ecological Assessment Group meeting at Ft. Cronkhite on October 26, 1990.

Since the Hunters Point property appears to contain salt marsh wetlands, it is appropriate for the Navy to have a formal wetlands delineation conducted. Additionally, habitat evaluation procedures should be utilized to determine the productivity of the wetlands and ensure that important habitat values are not lost during remediation. Similarly, the Navy must comply with the Endangered Species Act to ensure that remediation does not affect any listed species or critical habitat.

Response A:

The Environmental Sampling and Analysis Plan (ESAP) is not intended to be complete Ecological Risk Assessment. At the Technical Review Committee (TRC) meeting held on January 10, 1991, the U.S. Environmental Protection Agency requested that the Navy consider presenting a comprehensive Ecological Risk Assessment workplan in the future, of which the ESAP would become a component. There was a general consensus reached among TRC members that it would be more appropriate to address certain items such as a formal wetlands delineation, a habitat evaluation, species diversity studies, and the Endangered Species Act, in the Ecological Risk Assessment workplan rather than in the ESAP.

Comment B:

Indications have been received that sediments in the vicinity of the dry docks have been contaminated with TBT, copper sulphate and other toxic materials, and these sediments are acutely toxic to aquatic life.

Response B:

Three sampling stations have been added in the vicinity of the dry dock areas to evaluate this as agreed upon at the TRC meeting on January 10, 1991.

Comment C:

The Navy appeared to indicate, on October 24 at the Technical Review Committee and October 25 at the Ecological Assessment Group, that they feel it is unnecessary to assess contamination in areas not subject to dredging. However, they might have contributed to contamination of the sediment and should assess all contamination on their property. Evaluation of the alternative treatment means, including no action, should be conducted subsequent to determination of contamination.

Response C:

The assessment of both non-dredged and dredged (dry-dock) areas will be included in the sediment toxicity and bioaccumulative effects evaluation segments of the ESAP.

The results of tests proposed in the ESAP will be utilized to evaluate potential remedial measures, if necessary, subsequent to characterization of the sediment.

Comment D:

Similarly, the Navy should survey and compare benthic organisms in sediment areas with appropriate reference areas to determine the general health of the aquatic communities. Sterile sediments may be indicators of the presence of acute toxicants.

Response D:

As discussed above, a general consensus was reached at the January 10, 1991 TRC meeting that items such as habitat evaluations and species diversity studies would be more appropriately addressed in the Ecological Risk Assessment workplan.

APPENDIX B

Equipment and Glassware Cleaning Procedures for Metals and Organics Analyses

ATT

EQUIPMENT & GLASSWARE CLEANING PROCEDURE FOR METALS ANALYSES

The following procedures are recommended by the SMW Program (SWRCB, 1988) for the cleaning of equipment and glassware used for metals analyses:

- Soak equipment and glassware in the detergent MICRO® for 3 days prior to use
- Rinse thoroughly with tap water and follow with rinses of deionized water
- Soak in 6N HCl (reagent grade) for 3 days
- Rinse 6 times with Milli-Q® water (18 megaohm deionized water)
- Used glassware should be soaked for an additional 3 days in 7N HNO_3, followed by thorough rinsing with Milli-Q® water
- Soak in Milli-Q® water for 3 days and rinse with Milli-Q® water
- Oven or air dry in a covered polyethylene container previously cleaned with MICRO® and throughly rinsed with deionized and Milli-Q® water

ATT

EQUIPMENT & GLASSWARE CLEANING PROCEDURE FOR ORGANICS ANALYSES

The following procedures are recommended by the SMW Program (SWRCB, 1988) for the cleaning of equipment and glassware used for organics analyses:

- Wash equipment and glassware in hot, soapy water
- Rinse thoroughly with tap water and deionized water
- Rinse with glass-distilled methanol
- Rinse with glass-distilled petroleum ether

REFERENCE

SWRCB, State Water Resources Control Board, California State Mussel Watch 1986-1987., Water Quality Monitoring Report No. 88-3, 1988.

APPENDIX C

Preparation of Mussel Tissue Samples for Metals, Mercury, Organics, and Tributyltin Analyses

PREPARATION OF MUSSEL TISSUE SAMPLES FOR METALS ANALYSES

Sample digestion prior to analysis of antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc will be conducted using the following procedures (SWRCB, 1988):

- Place 3 to 5 gram wet weight aliquot of homogenized sample in 30 ml beaker and dry at 70° C for 72 hours (place in oven in clean polyethylene container covered with paper towels to avoid contamination)
- Weigh dried sample and add 5 ml of 70% pure HNO_3
- Reflux sample for 3 hours and take slowly to dryness
- Char sample at 350° C to decompose lipids and edissolve in 5 ml pure HNO_3
- Further oxidize sample by dropwise addition of 30% H_2O_2 and take to near dryness
- Redissolve sample in 20 ml of 1% HNO_3 in Milli- Q^R water and transfer to clean 30 ml polyethylene vial

PREPARATION OF MUSSEL TISSUE SAMPLES FOR MERCURY ANALYSIS

Sample digestion prior to analysis of mercury will be conducted using the following procedures (SWRCB, 1988):

- Place 0.5 to 1 gram wet weight aliquot of homogenized sample in 20 ml stoppered glass tube and add 3 ml of 2:1 solution of H_2SO_4 and HNO_3
- Digest in water bath for 3 hours at 50° C and cool

The following procedures to be used are an adaptation of the Stainton (1971) syringe procedure used by the SMW Program (SWRCB, 1988) for the transfer of nanogram quantities of mercury vapor for analysis by flameless atomic absorption spectrophotometry:

- Add 6 ml of 6% $KMnO_4$ gradually and allow sample to react for 12-18 hours; add an additional 1 ml of 6% $KMnO_4$ to ensure oxidation
- Clear sample with a few drops of 30% H_2O_2 and back titrate with 6% $KMnO_4$ until sample turns pink
- Aspirate 2 ml of sample, 2 ml of reductant and 6 ml of air into 10 ml syringe; cap and mix contents on vortex mixer for 10 seconds
- Inject mercury vapor into a 15 cm borosilicate glass cell fitted with silica end windows.

The reductant must be made up fresh daily and consists of 600 ml of metal-free water, 100 ml of H_2SO_4, 5 g NaCl, 10 g $(NH_2OH)\ 2H_2\ SO_4$ and 20 g of $SnSO_4$ diluted to 1000 ml with Milli-Q® water.

PREPARATION OF SAMPLES MUSSEL TISSUE FOR ORGANICS ANALYSES

Homogenized samples will be extracted for organics analyses according to the following procedures of the Food and Drug Administration (FDA, 1970) which are used by the SMW Program (SWRCB, 1988):

- Blend a 50 g wet weight sample aliquot for 2 minutes with 200 ml acetonitrile in a glass blender (with stainless steel blades) on high speed
- Filter sample with suction through a 8 cm Buchner funnel fitted with a prewashed Whatman #42 filter paper into a 500 ml separatory funnel
- Add 50 ml of petroleum ether to the funnel and shake vigorously for one to two minutes
- Add 5 ml of saturated NaCl and 300 ml of deionized water to the separatory funnel and mix vigorously in a horizontal position for 30 to 45 seconds
- Allow layers to separate and discard aqueous phase
- Gently wash the remaining solvent layer with two 50 ml portions of deionized water
- Discard washes and transfer 40 ml of the solvent layer to a glass stoppered graduated cylinder
- Add 3 gm anhydrous Na_2SO_4 to the cylinder and shake mixture vigorously

The following procedures modify the use of a Florisil column by the SMW Program (SWRCB, 1988) and allow for analysis by the alternative methods:

- Transfer the dried extract to a Kuderna-Danish (K-D) evaporative concentrator equipped with a 10 ml collection ampule
- Add a few clean boiling chips to flask and attach a three-ball Snyder column.
- Prewet Snyder column by adding 1 ml solvent (methylene chloride) to top and place K-D apparatus on steam or hot water bath so that concentrator tube and lower rounded surface of flask are bathed in hot water or vapor
- Adjust vertical position of apparatus and water temperature as required to complete concentration in 15-20 minutes
- When apparent volume of liquid reaches 1 ml, remove K-D apparatus and allow to drain at least 10 minutes while cooling
- Rinse K-D apparatus with small volume of solvent and adjust sample volume to 10 ml with the solvent to be used in instrumental analysis

PREPARATION OF MUSSEL TISSUE SAMPLES FOR TRIBUTYLTIN ANALYSIS

Homogenized samples will be extracted for tributyltin analysis according to the following procedures used by the SMW Program (SWRCB, 1988):

- Centrifuge 10 grams of tissue, 10 ml of 50% HCl, and 25 ml of methylene chloride for 15 hours to separate
- Remove methylene chloride and evaporate under a stream of air
- Dissolve residue in hexane
- Wash hexane in a 3% NaOH solution to remove all the monobutyl- and dibuty-tins, and reevaporate to dryness
- Digest residue with 1 ml concentrated nitric acid and dilute to 5 ml with deionized water
- Co-inject 10 μL of sample with 10 μL of matrix modifier consisting of 100 μg phosphate and 10 μg magnesium nitrate per analytical injection

REFERENCES

FDA, U.S. Food and Drug Administration, Pesticide Analytical Manual. Vol. I., Sec. 211.13f, Food and Feeds, Department of Health, Education and Welfare, 1970.

STAINTON, M. Syringe procedure for transfer of nanogram quantities of mercury vapor for flameless atomic absorption spectrophotometry. Anal. Chem. 43(4):625-627, 1971.

SWRCB, State Water Resources Control Board, California State Mussel Watch 1986-1987., Water Quality Monitoring Report No. 88-3, 1988.